Contents—Nov. 1946

Volume XXVII No. 11

ARCHIVES OF PHYSICAL MEDICINE
(Formerly Archives of Physical Therapy)

30 North Michigan Avenue, Chicago 2, Illinois

Original contributions, exchanges and books for review should be forwarded to the Editorial Office. All business matters including advertising should be handled through the Executive Office, 30 N. Michigan Ave., Chicago 2, Illinois. The statements in the manuscripts published in the ARCHIVES OF PHYSICAL MEDICINE are made solely on the responsibility of the author. The American Congress of Physical Medicine does not assume any responsibility for statements contained therein. Manuscripts accepted for publication in ARCHIVES OF PHYSICAL MEDICINE are for exclusive publication and may not be published elsewhere.

Subscription — In the United States, its possessions, and Mexico, $5.00 yearly; Canada, $5.50; elsewhere, $6.50 the year.
Advertising rates on application. All advertising copy subject to acceptance by publication committee.
Published monthly at Chicago, Illinois, by American Congress of Physical Medicine.
Entered as Second Class Matter, February 15, 1945, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

*In Active Service.

ORIGINAL ARTICLES

EDITOR OF THE MONTH

ARTHUR L. WATKINS, M.D.

Boston, Massachusetts

Printed in U. S. A.

APPROVED SCHOOLS FOR PHYSICAL THERAPY TECHNICIANS ‡

Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Medical Director	Technical Director	Entrance Requirements *	Duration of Course	Time of Admission	Maximum Enrollment	Tuition	Certificate, Diploma, Degree
Children's Hospital, Los Angeles[1]	Samuel Mathews, M.D.	Miss Lily Graham	a-b-c	14 mos.	Sept	14	$200	Diploma
College of Medical Evangelists, Los Angeles[1]	Fred B. Moor, M.D.	A. H. Carlson	a-b-c-d	12 mos.	Sept	20	$225	Cert. or Dipl.
University of California Hospital, San Francisco[1]	Frances Baker, M.D.	Miss Margery L. Wagner	a-b-c	12 mos.	MarchSept	10	$150	Certificate
Stanford University, Stanford University, Calif.[1]	W. H. Northway, M.D.	Miss Lucille Daniels	a-b-d	10 mos.	Quarterly	16	$409	Cert. or Degree
Northwestern University Medical School, Chicago	John S. Coulter, M.D.	Miss Gertrude Beard	a-b-d	12 mos.	JulyOct	16	$300	Certificate
State University of Iowa Medical School, Iowa City	W. D. Paul, M.D.	Miss Olive C. Farr	f	12 mos.	Sept	—	$200	**
University of Kansas School of Medicine, Kansas City[1]	G. M. Martin, M.D.	Miss Ruth G. Monteith	a-b-c[2]	12 mos.	FebSept	20	$ 50[3]	Cert. or Degree
Bouvé-Boston School of Physical Education, Boston	Arthur L. Watkins, M.D.	Miss Constance K. Greene	c[4]	10 mos.	Sept	15	$250[5]	Cert. or Degree
Boston University, College of Physical Education for Women, Sargent College, Cambridge, Mass.	Louis Howard M.D.	Miss Adelaide L. McGarrett	H.S.	4 yrs.	Sept	20	Varies	Cert. or Degree
University of Minnesota, Minneapolis[1]	M. E. Knapp, M.D.	Miss Ruby Green	H.S.	4 yrs.	Oct	24	$200[3]	Certificate
Barnes Hospital, St. Louis	F. H. Ewerhardt, M.D.	Miss Beatrice F. Schulz	a-b-c	12 mos.	Oct	12	$200	Certificate
St. Louis University School of Nursing, St. Louis[1]	A. J. Kotkis, M.D.	Sister Mary Imelda	a[2]	10 mos.	Jan-Sept	12	$250 yr.	Cert. or Degree
Columbia University, College of Physicians and Surgeons, New York City[1]	William B. Snow, M.D.	Miss Josephine L. Rathbone	a-c[6]	2 yrs.	Sept	35	$400 yr.	Cert. or Degree
New York University School of Education New York City[1]	George G. Deaver, M.D.	Miss Elizabeth C. Addoms	a-b-d	12 mos.	Sept	40	$525	Cert. & Degree
Duke Hospital, Durham N. C.[1]	Lenox D. Baker, M.D.	Miss Helen Kaiser	a-b-d	12 mos.	Oct	12	$300	Certificate
D. T. Watson School of Physiotherapy, Leetsdale, Pa.[1]	Jessie Wright, M.D.	Miss Kathryn Kelley	a-b-d	12 mos.	Oct	30	$200	Dipl. or Degree
Graduate Hosp. of the Univ. of Pennsylvania, Phila.[1]	G. M. Piersol, M.D.	Miss K. Sutherland	a-b-c	12 mos.	Sept	20	$200	Certificate
University of Texas School of Medicine, Galveston[1]	G. W. N. Eggers, M.D.	Miss Ruby Decker	a-b-d[8]	12 mos.[7]	Jan	6	$141[3]	Certificate
Baruch Center of Physical Medicine of the Medical College of Virginia, Richmond, in affiliation with Richmond Professional Institute[1]	F. A. Hellebrandt, M.D.	J. J. Buchanan, M.D.	a-b-c[2]	12 mos.†	Sept	20	$200[3]	Cert. or Degree
University of Wisconsin Medical School, Madison[1]	Elizabeth Grimm, M.D.	Miss Margaret A. Kohli	a-b-c[2]	12 mos.	Sept	20	$ 96[3]	Cert. or Degree

* Courses are so arranged that any of the entrance requirements will qualify students for training. a = Graduation from accredited school or nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; e = Four years of College with science courses; H. S. = High school graduation; f = degree in physical education or sciences.

† Currently eighteen Navy nurses are enrolled in a six-month emergency course.

1. Male students admitted.
2. High school graduates admitted to four-year course leading to degree.
3. Non-residents charged additional fee.
4. High school graduates admitted to four-year course leading to degree from Tufts College.
5. Tuition for degree course is $400 per year.
6. College graduates admitted to twelve-month certificate course.
7. Effective 1947 class.
8. Effective 1948 class.

‡ Reprinted in part J. A. M. A. 130:1156 (April 20) 1946.

** At the end of nine months the students can register in the graduate school for a degree of master of science in Physical Therapy.

CONSOLIDATED LIST OF APPROVED SCHOOLS FOR PHYSICAL THERAPY TECHNICIANS TO JULY 1, 1946

Approvals Granted by Council on Medical Education and Hospitals of the American Medical Association

Foreword. — The approved schools contained in this list give the dates of first approvals and the end of the period in which the school was actually approved.

It should be understood that graduates who were enrolled in the school prior to the time of disapproval and graduates who had contracted to begin their training period prior to the time of this disapproval are considered graduates of approved schools. Similar arrangements are made whenever it is necessary to disapprove internships and residencies.

The emergency courses operated by some of the schools have been disapproved in certain instances and all other emergency courses have been discontinued. Students who were enrolled in these schools at this time of disapproval were required to complete their supervised practice of six months in acceptable army hospitals. Therefore, some of these graduates might not have received their certificate before the emergency course was disapproved. These should also be considered as graduates of an approved course.

Prior to 1936 the American Medical Association was not responsible for the approval of schools for the training of physical therapists; therefore, all graduates who received their training prior to 1936 are not graduates of schools approved by the American Medical Association.

Evidences of professional qualifications are commonly considered to be membership in the American Physiotherapy Association or registration by the American Registry of Physical Therapy Technicians.

	Name and Location of School	Approval of Regular Course	Approval of Emerg. Course
1.	Station Hospital, Fort Huachuca, Arizona	----------	11-44 to 2-45
2.	Army and Navy Gen. Hospital, Hot Springs, Arkansas	----------	6-43 to 11-44
3.	California Hospital, Los Angeles	12-38 to 2-42	----------
4.	Children's Hospital, Los Angeles	8-36 to present	9-41
5.	Coll. Med. Evangelists, Los Angeles	6-42 to present	----------
6.	Univ. South. California, Los Angeles	6-46 to present	----------
7.	Univ. Calif. Hospital, San Francisco	11-42 to present	----------
8.	Stanford Univ., Stanford Univ., Calif.	8-36 to present	8-41
9.	Fitzsimons Gen. Hosp., Denver, Colo.	----------	6-43 to 12-45
10.	Walter Reed Gen. Hosp., Wash., D. C.	8-36 to 12-45	4-41 to 12-45
11.	Lawson Gen. Hosp., Atlanta, Ga.	----------	11-44 to 12-45
12.	Northwestern Univ., Chicago, Ill.	8-36 to present	8-41
13.	State of Univ. of Iowa, College of Medicine, Iowa City, Iowa	6-43 to present	1-43
14.	Univ. of Kansas, School of Medicine, Kansas City, Kan.	2-45 to present	----------
15.	Bouve-Boston Sch. Phys. Ed., Boston	8-36 to present	5-42
16.	Harvard Med. Sch., Boston	8-36 to present	2-42
17.	Posse-Nissen School, Boston	----------	----------
	Posse Sch. or Posse Inst., Boston	2-39 to 2-43	----------
18.	Boston Univ. (Sargent College), Cambridge, Mass.	8-36 to present	----------
19.	Battle Creek Coll., Battle Creek, Mich.	8-36 to 8-38	----------
20.	Percy Jones Gen. Hosp., Battle Creek, Mich.	----------	11-44 to 12-45
21.	Univ. Minn., Minneapolis	2-42 to present	----------
22.	Mayo Clinic, Rochester, Minn.	2-39 to 2-46	12-41 to 2-46
23.	Barnes Hosp., St. Louis, Mo.	6-42 to present	----------
24.	St. Louis Univ. Sch. of Nursing, St. Louis, Mo.	8-36 to present	2-44
25.	O'Reilly Gen. Hosp., Springfield, Mo.	----------	6-43 to 12-45
26.	Albany Hosp., Albany, N. Y.	6-46 to present	----------
27.	Univ. Buffalo, Buffalo, N. Y.	8-36 to 2-44	8-41 to 2-44
28.	Columbia Univ., New York, N. Y.	2-44 to present	----------
29.	Hosp. for Ruptured and Crippled, N. Y. Hosp. for Special Surgery, N. Y., N. Y.	10-36 to 12-45	10-41 to 12-45
30.	New York Univ., New York, N. Y.	4-42 to present	----------
31.	Duke Hospital, Durham, N. C.	11-43 to present	----------
32.	Cleveland Clinic Foundation Hosp., Cleveland	11-42 to 2-46	----------
33.	D. T. Watson Sch. Physiotherapy, Leetsdale, Pa.	8-36 to present	11-41
34.	Graduate Hosp., Univ. Pa., Phila.	2-43 to present	----------
35.	Univ. of Texas Sch. Med., Galveston	2-44 to present	----------
36.	Brooke Gen. Hosp., San Antonio, Tex.	----------	6-43 to 12-45
37.	Bushnell Gen. Hosp., Brigham City, Utah	----------	2-45 to 12-45
38.	Baruch Center of Physical Med., Med Coll. of Va., Richmond, Va.	12-45 to present	2-46
39.	Richmond Professional Institute, Richmond, Va.	8-36 to date but now affiliated with Baruch Center	----------
40.	Ashford General Hospital, White Sulfur Springs, W. Va.	----------	11-44 to 12-45
41.	Univ. Wis. Med. Sch., Madison, Wis.	8-36 to present	4-42

APPROVED SCHOOLS FOR OCCUPATIONAL THERAPY TECHNICIANS *

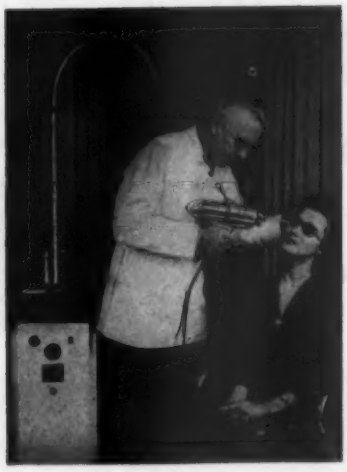
Council on Medical Education and Hospitals of the American Medical Association

NOTE: The duration of the course is expressed in academic years and in most schools the accelerated curriculum is being followed.

Name and Location of School	College Affiliation	Duration of Course	Classes Start	Entrance Requirements	Tuition Per Year	Certificate, Diploma, Degree	Graduates in 1945
University of Southern California, 3551 University Ave., Los Angeles	University of Southern California	2 yrs. 5 yrs.	Sept FebSept	Degree High sch.	$330 $330	Certificate Cert.&B.S.	8
Mills College, Oakland, Calif.	Mills College	3 yrs. 5 yrs.	FebSept FebSept	Degree High sch.	$200 $450	Certificate Cert.&Deg.	4
San Jose State College, San Jose, Calif.	San Jose State College	3 yrs. 5 yrs.	JanOct Varies	1 yr. coll. High sch.	$ 21 $ 21	Certificate Degree	1
University of Illinois College of Medicine, 1853 W. Polk St., Chicago	University of Illinois	4½ yrs.	Varies	High sch.	$ 80	B.S.	None
University of Kansas, Lawrence	University of Kansas	2 yrs. 4 yrs.	FebSept FebSept	Degree High sch.	$ 50 $ 50	Certificate B.S.	1
Boston School of Occupational Therapy, 7 Harcourt St., Boston	Tufts College	2 yrs. 3 yrs. 5 yrs.	Sept JulySept Sept	Degree 1 yr. coll. High sch.	$400 $400 $400	Diploma Diploma Dipl.&B.S.	41
Kalamazoo School of Occupational Therapy, Western Michigan College of Education, Kalamazoo	Western Michigan College of Education	2 yrs. 4 yrs.	July FebSept	Degree 1 yr. coll.	$ 51 $ 95	Certificate Cert.&Deg.	20
Michigan State Normal College, Ypsilanti	Michigan State Normal College and Univ. of Michigan	5 yrs.	Varies	High sch.	$ 67	Cert.&Deg.	8
St. Louis School of Occupational and Recreational Therapy, 4567 Scott Ave., St. Louis	Washington University	3 yrs.	Sept	2 yrs. coll.	$350	B.S.	13
University of New Hampshire, Durham	Univ. of New Hampshire	5 yrs.	Sept	High sch.	$160	Cert.&Deg.	5
Columbia University College of Physicians and Surgeons, 630 W. 168th St., New York City	Columbia University	2 yrs. 3 yrs.	Sept Sept	Degree 2 yrs. coll.	$450 $450	Certificate B.S.	18
New York University School of Education, 100 Washington Sq. E., New York City	New York University	4½ yrs.	Quarterly	High sch.	$450	Cert.&Deg.	13
Ohio State University, Columbus	Ohio State University	4½ yrs.	Quarterly	High sch.	$ 80	B.S.	11
Philadelphia School of Occupational Therapy, 419 S. 19th St., Philadelphia	University of Pennsylvania	2 yrs. 3 yrs. 5 yrs.	Sept Sept Varies	Degree 1 yr. coll. High sch.	$400 $400 $400	Diploma Diploma Dipl.&B.S.	45
Richmond Professional Institute, 901 W. Franklin St., Richmond, Va.	College of William and Mary	2½ yrs. 3 yrs.	Sept Sept	Degree 1 yr. coll.	$200 $200	Certificate Diploma	4
Milwaukee-Downer College, Dept. of Occupational Therapy, 2512 E. Hartford, Milwaukee	Milwaukee-Downer College	3 yrs. 5 yrs.	Sept Sept	1 yr. coll. High sch.	$250 $250	Diploma Dipl.&B.S.	15
Mount Mary College, 2900 Menomonee River Dr., Milwaukee	Mount Mary College	5 yrs.	Sept	High sch.	$210	B.S.	7
University of Toronto, Dept. of University Extension, Toronto, Ont., Canada	University of Toronto	3 yrs.	Sept	1 yr. coll.	$175	Diploma	40

* Reprinted J. A. M. A. 130:1155 (April 20) 1946.

FOR SPECIALIZED LOCAL ULTRAVIOLET APPLICATIONS, YOU NEED THE



HANOVIA AERO-KROMAYER ULTRAVIOLET AIR-COOLED LAMP

American Medical Assn. ACCEPTED Council on Physical Medicine

Specifically developed and designed for the most practical and beneficial local applications of ultraviolet, the new Aero-Kromayer is essential to a complete physical therapy practice.

Exclusive features make the Hanovia Aero-Kromayer the outstanding performer in its field. The following advantages are a few of the many provided by this equipment.

New aero-dynamic principle permits air cooling of burner housing . . . kinking of water tubes and water stoppage eliminated . . . self-lighting, higher intensity burner . . . more concentrated ultraviolet output through applicators.

Complete detailed information
promptly available upon request.

HANOVIA Chemical & Manufacturing Co.

World's largest manufacturers of ultraviolet equipment for the Medical Profession.

DEPT. 306-L NEWARK 5, N. J.

CUTANEOUS TEMPERATURE OF THE EXTREMITIES OF NORMAL SUBJECTS AND OF PATIENTS WITH RHEUMATOID ARTHRITIS *

GORDON M. MARTIN, M.D.
Fellow in Physical Medicine
Mayo Foundation
GRACE M. ROTH, Ph.D.
Section on Clinical Physiology
EARL C. ELKINS, M.D.
and
FRANK H. KRUSEN, M.D.
Section on Physical Medicine
Mayo Clinic
ROCHESTER, MINN.

I. Vasomotor Adaptability

Various therapeutic measures related to the field of physical medicine have long been used as parts of the treatment of patients with rheumatoid arthritis. Few carefully controlled studies have been done to determine the physiologic effects of these agents in health and in disease. It is known empirically that heat, massage and exercise are of considerable value for the relief of pain, mobilization of partially stiffened joints, prevention of ankylosis and improvement of circulation. However, there remains a desire in the minds of many to know more exactly what physiologic effects the simple and easily available physical agents may have on the body. Since patients with rheumatoid arthritis constitute a large percentage of patients who receive physical therapy, it seemed desirable to attempt to determine the status of the peripheral circulation and vasomotor adaptability as measured by the responses of cutaneous temperature of the extremities among such patients and in a group of normal persons.

Peripheral Circulation of Patients with Rheumatoid Arthritis

Medical literature contains frequent comments about the decreased and sluggish peripheral circulation of patients who have rheumatoid arthritis. Pale, cold, clammy hands long have been thought of as representing one of the commoner systemic manifestations of rheumatoid arthritis. In 1930 Wright and Pemberton[1] found that 75 per cent of their group of arthritic patients had lower cutaneous temperatures at the base of the finger nails than did normal persons under similar conditions. In 1933 Kovacs, Wright and Duryee[2] found that the cutaneous temperature in the fingers of 51 per cent of patients who had chronic rheumatoid arthritis was lower than that of normal patients. In addition, Wright and Pemberton found that on exposure to cold the cutaneous temperature of the extremities decreased less and then returned to pre-cold room levels slower than it did in normal persons. This

* Abridgment of a thesis submitted by Dr. Martin to the Faculty of the Graduate School of the University of Minnesota in partial fulfilment of the requirements for the degree of Master of Science in Physical Medicine.

1. Wright, Lillie M., and Pemberton, Ralph: The Peripheral Surface Temperature in Arthritis, Arch. Int. Med. 45:147 (Jan.) 1930.

2. Kovacs, J.; Wright, I. S., and Duryee, A. W.: Surface Temperature and the Minute Blood Vessels of the Skin in Arthritis, J. A. M. A. 100:1018 (April 1) 1933.

indicated that disturbances in peripheral blood flow were important factors in the rheumatoid syndrome.

Steinbrocker and Samuels[3] in 1941 reported that 59 per cent of a series of 47 patients who had rheumatoid arthritis showed evidence of vasospastic arterial disturbance. In contrast, however, in a series of 71 patients with osteoarthritis, only 33 per cent exhibited evidence of vasospastic disturbance. Steinbrocker and Samuels concluded that the occurrence of vasospastic states was common among patients who had rheumatoid arthritis but was less common among patients with osteoarthritis.

On the other hand, Woodmansey and his associates[4] noted that patients with rheumatoid arthritis showed a "poorer response" to contrast baths than did normal persons. This response indicated an attenuated blood supply, which they concluded resulted from disuse of a part rather than from any vasospastic conditions.

Rowntree, Adson[5] and Hench[6] reported on a series of 17 patients with rheumatoid arthritis who showed evidence of vasomotor disturbance. Surgical removal of the lumbar sympathetic trunks and ganglions or removal of the lower cervical and first two thoracic sympathetic ganglions and the intervening trunks was carried out in this group. After the surgical procedures an increase of cutaneous temperature of the fingers and toes of from 5° to 10° C. (9° to 18° F.) was noted. The capillaries appeared narrowed and the rate of blood flow markedly increased; pain was relieved, and the condition of the nails and muscles was improved.

Prusík[7] expressed the belief that vascular changes in the skin of patients who had rheumatoid arthritis consisted only in venous congestion of the skin over the inflamed joints. He found no characteristic changes in the capillaries of patients with rheumatoid arthritis. Abramson[8] concluded that patients with arthritis generally have signs pointing to diminished circulation, probably through the smaller vessels.

Procedure

Selection of Subjects. — The subjects for this study were divided into two groups: (1) healthy volunteers and (2) patients suffering with rheumatoid arthritis.

Group 1 consisted of eleven healthy persons, including 1 man and 10 women, ranging in age from 21 to 36 years.

Group 2 consisted of 9 women and 15 men ranging in age from 21 to 54 years. The patients who were selected for the studies of vasomotor adaptability all were hospitalized patients suffering from rheumatoid arthritis involving the spinal column or one peripheral joint or more, or both the spinal column and one joint or more. The diagnosis was made by consultants who customarily see arthritic patients. The majority of patients had disease which was fairly active as evidenced by elevation of the sedimentation time of the erythrocytes. The patients represented as nearly an uncomplicated picture of rheumatoid arthritis as could be obtained. Patients who had associated nephritis, gout, diabetes or other systemic diseases were not included. It was believed that in all cases the patient's condition could be clinically improved by a period of several weeks' hospitalization.

Vasomotor Adaptability. — When a patient who had rheumatoid arthritis was admitted to the hospital, his or her vasomotor adaptability was determined by observance of the response of the cutaneous temperature of the extremities in three psychrometric rooms: a normal room maintained at 25.5 C. (78 F.), a cold room maintained at 19 to 21 C.

3. Steinbrocker, O., and Samuels, S. S.: The Articular Circulation of the Lower Extremities in Chronic Arthritis, J. Lab. & Clin. Med. 26:974 (March) 1941.
4. Woodmansey, A.; Collins, D. H., and Ernst, M. M.: Vascular Reactions to the Contrast Bath in Health and in Rheumatoid Arthritis, Lancet 2:1360 (Dec. 10) 1938.
5. Adson, A. W., and Rowntree, L. G.: The Surgical Indications for Sympathetic Ganglionectomy and Trunk Resection in the Treatment of Chronic Arthritis, Surg., Gynec. & Obst. 50:204 (Jan.) 1930. Rowntree, L. G., and Adson, A. W.: Bilateral Lumbar Sympathetic Ganglionectomy and Ramisectomy for Polyarthritis of the Lower Extremities, J. A. M. A. 88:694 (Mar. 5) 1927.
6. Rowntree, L. G.; Adson, A. W., and Hench, P. S.: Preliminary Results of Resection of Sympathetic Ganglia and Trunks in Seventeen Cases of Chronic "Infectious" Arthritis, Ann. Int. Med. 4:447 (Nov.) 1930.
7. Prusík, Bohumil: Blood Circulation of the Skin in Rheumatism, Acta rheumatol 2:17 (Nov.) 1930.
8. Abramson, D. I.: Vascular Response in the Extremities of Man in Health and Disease, Chicago, University of Chicago Press, 1944.

(66.2 to 69.8 F.) and a hot room maintained at 32.2 to 33.3 C. (90 to 92 F.) all with a relative humidity of 40 per cent. The patients had fasted for fifteen hours prior to the tests, and during the time of testing they wore lightweight short pajamas and were in a supine position on comfortable beds. The temperature of the plantar surfaces of the first and third toes of both feet and that of the volar side of the distal phalanges of the first and third fingers of both hands were measured by means of copper-constantan thermocouples at ten minute intervals, except during periods of rapid change of temperature, when readings were made at five minute intervals. Rectal temperature was measured by means of a thermocouple simultaneously with the temperature of the extremities. Oral temperature was recorded at various intervals during the observations.

Since it had been shown that an approximately linear relationship[3] (which, however, seems to be of a dual character) exists between the average skin temperature of the toes and the basal metabolic rates obtained under environmental conditions of 25 C. (77 F.) with a relative humidity of 40 per cent, basal metabolic rates were determined on the day before or the day after the measurements of skin temperature had been made.

In order to demonstrate vasomotor adaptation, cutaneous temperature was measured after the subjects had been moved from a comfortable to a cooler environment and later to a warmer environment, before any treatment was given. After the patients had received an intensive course of treatment for rheumatoid arthritis for two to five weeks, the vasomotor reactions were determined again. The treatment included daily physical therapy. For some patients artificial fever, induced by the intravenous administration of typhoid vaccine, was produced one to three times. In all cases acetylsalicylic acid was used as needed for control of pain. Several patients received high voltage roentgen ray therapy to the back according to the technic described by Smyth, Freyberg and Lampe[9] for rheumatoid arthritis of the spinal column. Daily physical medicine treatments included the applications of some form of heat usually generated by two radiant heat bakers, a hot humid air cabinet or by a hot bath in a Hubbard tank. Deep effleurage and pétrissage type of massage was carried out daily on the affected parts, after the application of heat. All patients had daily supervised exercises to increase or maintain the mobility of the involved parts. If hands or feet were involved, the patient also received contrast baths for these parts twice daily for twenty-four minutes.

Results

Normal Persons. — The vasomotor adaptability of the normal persons is shown in table 1 and figure 1. When a normal person remained for an hour

TABLE 1. — *Vasomotor Response of Normal Persons to Change in Environmental Temperature.*

Subject	Sex and Age	Basal Metabolic Rate, %	Oral Temperature	Average Cutaneous Temperature, °C.					
				Basal Temperature in Normal Room		Decrease Below Basal Temperature in Cold Room		Increase Above Basal Temperature in Hot Room	
				Toes	Fingers	Toes	Fingers	Toes	Fingers
30	F23	+ 5	37.0	24.3	24.9	3.8	3.0	3.8	9.2
31	F24	+ 2	36.6	22.8	24.3	3.5	3.5	5.0	8.3
32	F38	—10	36.9	25.3	24.3	3.8	2.3	6.1	8.9
33	F22	— 6	36.4	24.5	31.6	....	....	7.4	3.7
35	F21	—11	36.3	29.5	26.3	6.7	3.2	3.9	5.6
36	F21	— 1	36.7	23.4	30.9	1.2	5.4	8.7	3.9
37	F36	— 6	36.4	26.1	26.7	2.6	3.6	8.4	8.3
39	F23	—25	36.2	25.8	27.9	5.2	6.1	8.0	7.5
40	F21	— 5	36.2	24.2	28.4	3.2	5.8	8.9	6.6

or more at an environmental temperature of 25.5 C. (78 F.) with a relative humidity of 40 per cent, fairly constant readings were obtained and these exhibited definite correlation with the basal metabolic rate. When the normal person was moved to a cooler environment of 20 C. (68 F.), there was relatively little thermal change in the forehead, thorax, arms and upper portions of the legs. In contrast, there was definite cooling of the toes, and constancy of temperature (approximately that of the room) was reached in about an hour, except for those subjects who had higher basal metabolic

9. Smyth, C. J.; Freyberg, R. H., and Lampe, Isadore: Roentgen Therapy for Rheumatoid Arthritis of the Spine (Marie-Strümpel Arthritis; Spondylitis Rhizomélique), J. A. M. A. 117:826 (Sept. 6) 1941.

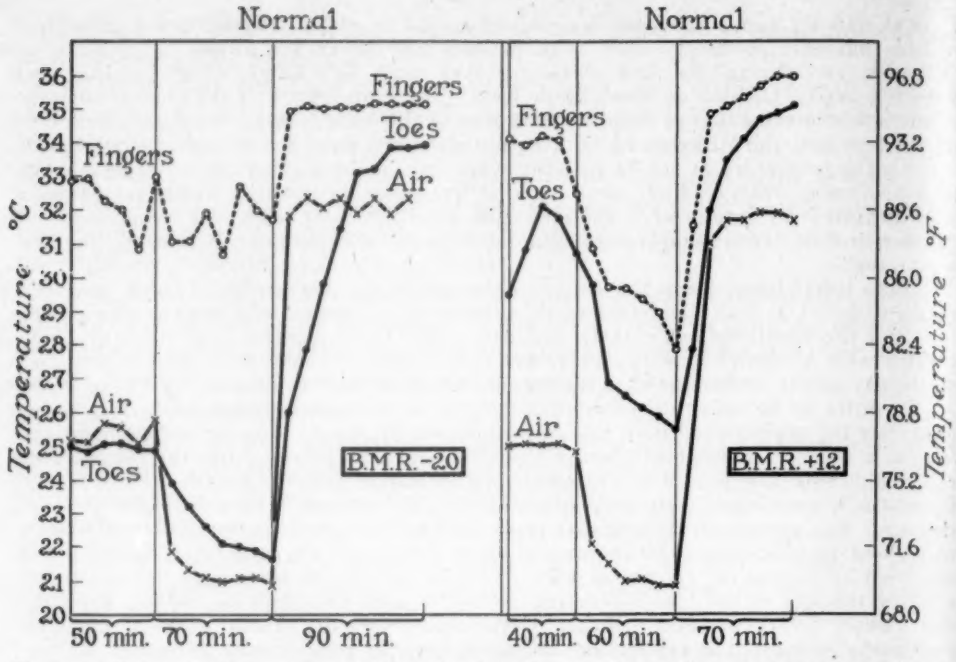


Fig. 1. — Changes in the temperature of the skin of the fingers and toes of a normal person according to changes of environmental temperature. Note the variation of skin temperature of the fingers and toes associated with a variation of basal metabolic rate.

TABLE 2. — *Vasomotor Response of Patients with Rheumatoid Arthritis, Before and After Treatment.*

Subject	Sex and Age	Basal Metabolic Rate, %	Before or After Treatment	Days Treated	Oral Temperature	Average Cutaneous Temperature, °C.					
						Basal Temperature in Normal Room		Decrease Below Basal Temperature in Cold Room		Increase Above Basal Temperature in Hot Room	
						Toes	Fingers	Toes	Fingers	Toes	Fingers
1	M28	— 7	Before	....	37.0	24.9	31.4	3.5	4.7	4.5	2.7
		+ 2	After	9	37.0	24.1	33.9	3.5	4.6	4.7	1.6
2	M27	—14	Before	....	36.6	27.0	35.4	4.8	9.4	5.0	1.1
		—11	After	9	36.6	27.3	34.1	3.5	3.6	5.2	1.6
3	M35	0	Before	....	36.6	29.4	26.5	7.0	4.3	3.3	6.0
		+ 5	After	7	36.2	27.7	25.6	3.2	1.9	4.2	8.7
4	F 39	+ 2	Before	....	36.9	29.0	30.9	1.3	3.4	5.6	4.4
		— 4	After	28	36.9	27.1	31.7	4.2	7.3	6.7	4.0
5	F 47	— 8	Before	....	36.5	28.5	26.9	3.7	3.7	3.8	6.5
		— 9	After	21	36.7	28.8	29.1	4.9	5.6	3.1	2.4
6	M27	—20	Before	....	36.7	27.9	34.6	3.9	9.1	2.5	0.6
		—26	After	18	36.6	24.6	33.5	3.0	8.1	5.5	0.6
7	M36	— 3	Before	....	37.2	25.1	31.2	3.6	8.9	7.6	4.4
		— 3	After	19	36.3	25.6	32.9	3.2	6.4	6.3	3.6
8	M46	+11	Before	....	37.2	30.9	33.0	3.5	5.7	2.8	1.5
		+ 2	After	14	36.4	31.2	33.2	3.9	7.4	2.0	1.1
9	M31	+17	Before	....	36.7	29.8	34.1	3.6	1.8	4.3	1.5
		+ 7	After	26	36.6	30.9	33.9	7.8	8.9	3.1	1.7
10	F 30	+ 1	Before	....	37.2	25.9	33.4	5.2	9.1	8.4	1.5
		— 5	After	21	36.4	26.0	31.2	4.9	6.5	7.3	5.1
11	M19	+11	Before	....	36.8	24.6	32.8	4.8	10.0	8.9	2.6
		—10	After	21	36.4	32.3	34.2	8.4	9.7	1.9	1.4
12	M29	— 8	Before	....	36.7	30.1	32.8	9.4	11.2	3.8	2.5
		—13	After	17	36.4	31.0	34.1	9.0	8.6	2.7	1.0
13	M38	+ 8	Before	....	37.2	31.1	26.9	4.9	4.4	4.1	9.2
		+ 8	After	30	36.7	25.7	29.0	5.2	8.6	7.8	7.5
14	M27	—13	Before	....	36.6	30.2	32.3	8.4	10.7	4.6	3.2
		— 5	After	28	36.6	28.7	33.5	8.2	11.7	4.8	1.8
15	F 39	— 5	Before	....	36.0	28.3	29.3	5.0	6.1	5.5	5.7
		—22	After	28	36.3	28.1	27.7	5.6	4.6	5.6	7.0

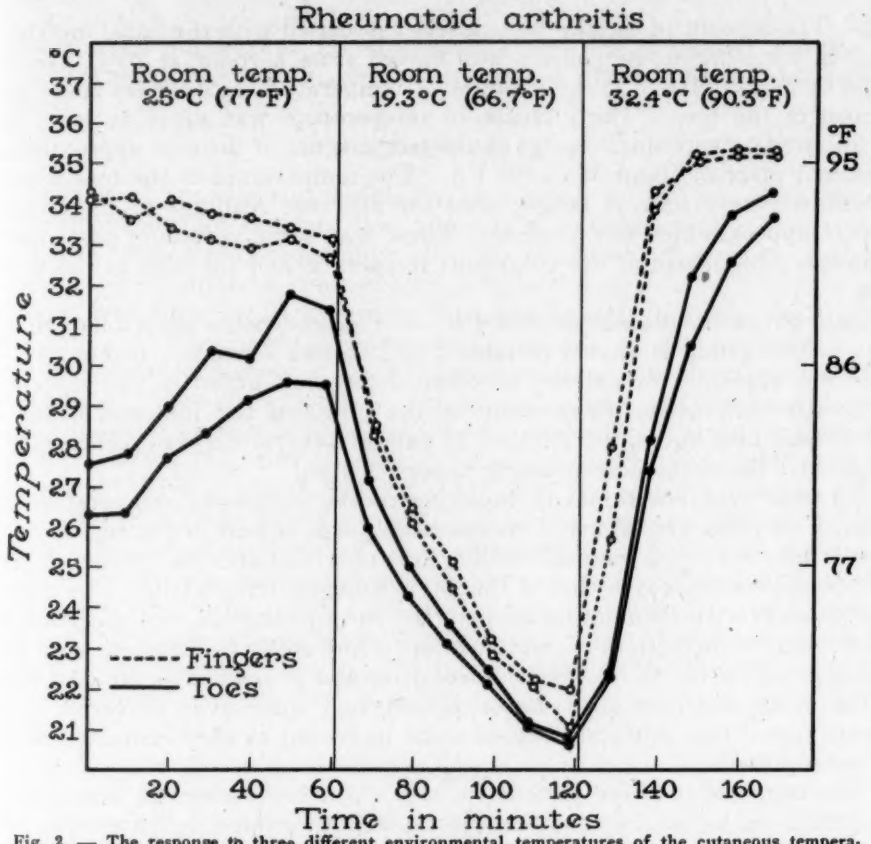


Fig. 2. — The response to three different environmental temperatures of the cutaneous temperature of the fingers and toes of patient 12, who had rheumatoid arthritis of the spinal column.

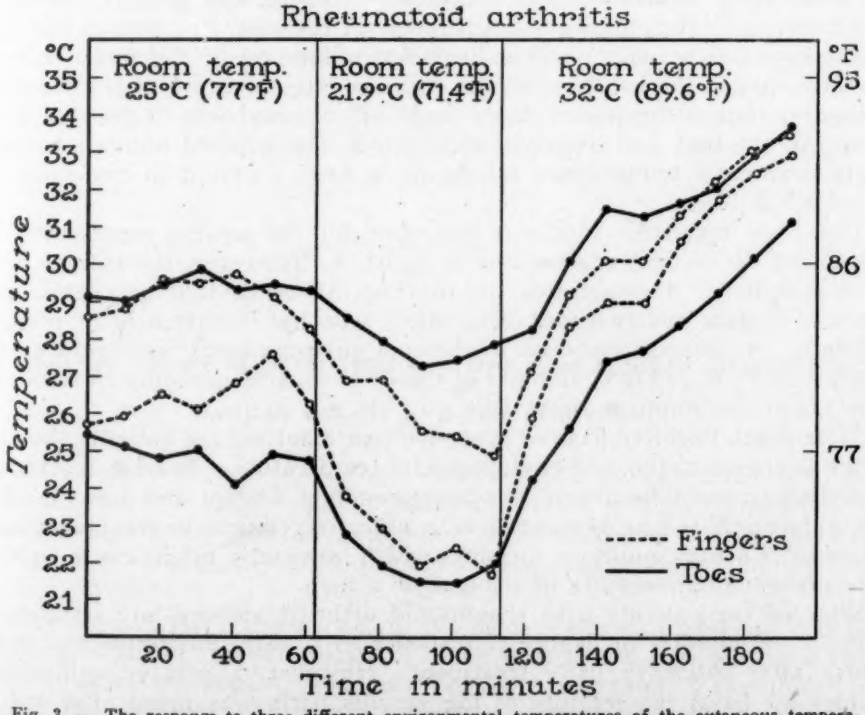


Fig. 3. — The response to three different environmental temperatures of the cutaneous temperature of the fingers and toes of patient 5, who had involvement of peripheral joints.

rates. The amount of cooling was closely associated with the basal metabolic rate. In turn, when the subject was moved from a room at 20 C. (68 F.) to one of 32 C. (89.6 F.), the changes of temperature again were most pronounced in the toes. The increase of temperature was rapid at first; this was followed by a gradual change as the temperature of the toes approximated a maximal value of about 35 C. (95 F.). The temperature of the toes usually lay within a very narrow range; also, the different readings of finger temperature approximated one another. There was some variation, particularly in the rate of increase of the cutaneous temperature of the toes in the warm room.

Patients with Rheumatoid Arthritis. — The vasomotor adaptability of patients in this group is shown in table 2 and figures 2 and 3. In contrast to the normal subjects, the patients who had rheumatoid arthritis, and especially those with asymmetric involvement of the joints of the feet and hands or even elbows and knees, were found to exhibit several degrees' difference in temperature between corresponding fingers or toes.

In the cool environment, lowering of the cutaneous temperature occurred in all instances. When a thermocouple was placed in the region of an actively inflamed joint, minimal cooling was observed and the cutaneous temperature did not approach that of the environmental temperature. The majority of patients with rheumatoid arthritis did not tolerate the cool environment well. Several of the patients complained of feeling chilly in the room with normal temperature (25 C. or 77 F.). Several refused to remain in the cool room for the usual one hour observation period, and some even shivered. All patients stated that stiffness seemed to be increased as they remained in the cool environment.

The response of these patients to the warm environmental temperature was similar to that of the normal subjects. In both groups the cutaneous temperature of the fingers usually showed a prompt increase to above that of the environment, indicating vasodilatation. There was greater variation in the response of the cutaneous temperature of the toes. In a few of the normal subjects and patients with arthritis vasodilatation of the feet occurred soon after that in the hands, with the cutaneous temperature of the toes approximating that of the fingers. More frequently the response of the skin temperature of the toes was sluggish, with only a very gradual increase toward the environmental temperature taking place over a period of one hour to one and a half hours.

The basal metabolic rate was the same for the patient represented in figure 2 and the patient represented in figure 3. However, the patient concerned in figure 3 demonstrates the marked difference that may exist between two fingers and two toes of a patient who has involvement of peripheral joints. A sluggish response to the cool environmental temperature and a moderately slow and irregular rise of the cutaneous temperature in response to the warm environment occurred.

After seven to thirty days of intensive treatment, all the patients showed a better tolerance to the cool environmental temperature. In most instances, the cutaneous temperatures of the corresponding fingers and toes became more uniform. This was associated with objective clinical improvement and subsidence of acute conditions of joints which previously might cause an elevated cutaneous temperature in a finger or a toe.

None of the patients with rheumatoid arthritis showed any significant change in the rapidity or degree of response to a warm environmental temperature after intensive daily treatment. However, a greater uniformity in values for basal temperature of the various parts was noted after treatment of the patient in the hospital, and this paralleled somewhat the clinical

improvement; but except for this change and the increased tolerance to cold there was little change in the vasomotor adaptability of the arthritic patients.

Comment

Studies of vasomotor adaptability in a group of patients with rheumatoid arthritis do not indicate that there is a constant defect in peripheral circulatory adaptability associated with this condition. However, there was noted in the majority of the patients an intolerance to cold which in some instances was associated with a very slow decrease of the cutaneous temperature in the cold room. This demonstrated an inability of these patients to conserve body heat by means of prompt constriction of the cutaneous vessels of the hands and feet such as occurs normally. A slow and irregular increase of the cutaneous temperature of the toes in response to a warm environment frequently was noted; this observation confirms the findings of Wright and Pemberton.[1] It was also noted, however, that the skin temperature of the toes of normal persons frequently shows the same sluggish response in vasodilatation in a warm environment, even when the basal metabolic rate is within normal limits. The most marked deviations of cutaneous temperature were noted in the regions of actively inflamed joints of arthritic patients. For instance, a "hot ankle" might be associated with a skin temperature of the first or third toe or both that was several degrees higher than the temperature of the corresponding toes on the foot which did not have an active inflammatory process.

Summary

Patients who have rheumatoid arthritis frequently exhibit an intolerance to cool environmental temperatures that is associated with an abnormally sluggish and incomplete vasoconstriction in the hands and feet in response to cold.

Among persons who have rheumatoid arthritis, cutaneous vasodilatation in the feet may occur at a slower and more irregular rate in response to a warm environmental temperature than it does among normal persons or among patients with rheumatoid arthritis limited to the spinal column.

II. Relative Effects of Moist Heat and Dry Heat Applied Generally to the Body or Locally to a Part of the Body

Until recently, the physiologic effects of heat on the human body have been only vaguely understood by members of the medical profession. As the collection of new data has proceeded, fairly clear and well founded concepts of the various physiologic effects of heat have been and are being gradually evolved.

Since one of the controversies in the field of physical medicine has been concerned with the relative merits of moist heat versus dry heat as a therapeutic measure, the present study was begun to determine, if possible, which form of heat produced the greatest elevation of cutaneous temperature with the longest duration.

Procedure

Selection of Patients. — The persons concerned in this study were divided into two groups: 10 normal subjects and 6 patients with rheumatoid arthritis. Certain aspects of the clinical status of the latter group were presented in a separate communication arising from the present study.[1]

The various values for cutaneous temperature of the extremities were measured in a room which had a constant temperature of 25.5 C. (78 F.), with a relative humidity of 40 per cent. The persons had fasted for fifteen hours prior to the tests. During the time of testing they wore lightweight short pajamas and were in a supine position on comfortable beds. The temperatures of the plantar surfaces of the first and third toes of both feet and the volar side of the distal phalanges of the first and third fingers of both hands were measured by means of copper-constantan thermocouples at ten minute intervals, except during periods of rapid change, when readings were made at five minute intervals.

Rectal temperature was measured by means of a thermocouple simultaneously with the temperature of the extremities; oral temperature was recorded at various intervals during the observations.

Generalized or Systemic Heating. — Three means were employed for the application of heat to the whole body: luminous heat bakers, hot tub baths and hot humid air cabinets. The first produces a type of dry heat; the latter two means can be classed as producing moist heat.

Dry Heat: Luminous or radiant heat bakers made of sheet metal 24 inches (61 cm.) long and 22 inches (56 cm.) high were used. These are equipped with ten 40 watt carbon filament bulbs and have a switch which controls the intensity of the heat. Two bakers were placed in position over either the anterior or the posterior surface of the uncovered body for thirty minutes. The thermocouples were applied before the application of heat was started and observations were made at ten minute intervals until the basal cutaneous temperatures were obtained. During the application of heat, readings of the cutaneous temperature were made at five minute intervals. When the bakers were removed, readings were continued at ten minute intervals until the basal cutaneous temperature again was reached.

Moist Heat: Systemic heating also was done with the patient or subject in a hot humid air cabinet. Temperature in the cabinet was maintained between 43.3 and 46.1 C. (110 and 115 F.), with a relative humidity in excess of 95 per cent. The oral temperature was elevated to about 38.3 C. (101 F.) in twenty to forty-five minutes. When this temperature was reached, the subject or patient was immediately wrapped in a heavy blanket and moved, on a surgical cart, to the constant temperature room in a horizontal position. Excess moisture was sponged off, cotton pajamas were put on, and recordings of oral, rectal and cutaneous temperatures were made at ten minutes intervals until the previously determined basal levels for cutaneous temperatures of the extremities were reached.

The hot tub bath was given in a modified Hubbard tank. The temperature of the water was maintained between 38.3 and 41.1 C. (101 and 106 F.). Underwater massage and exercise, usually carried out when arthritic patients are treated in the Hubbard tank, were omitted. The subject was kept in the bath until the oral temperature reached about 38.3 C. (101 F.). The subject was then immediately wrapped in a blanket, placed on a surgical cart and taken to the constant temperature room. The cooling curve was determined by studies of cutaneous temperature as described previously.

Local Application of Heat. — Dry heat: Radiant heat was applied by a single sheet metal baker equipped with ten carbon filament bulbs. The baker was placed over one foot and leg to the knee. Heat was applied for thirty minutes. Readings of the cutaneous temperatures of all extremities were made every five minutes during the application and at ten minute intervals after removal of the baker, until the basal cutaneous temperatures were reached.

Paraffin: Under basal conditions, a hot paraffin bath at 50 C. (122 F.) was used for one hand. The hand was dipped momentarily into the paraffin, allowed to cool slightly and then redipped. This was done eight to ten times in a period of five minutes, or until a coating of about ¼ inch (0.64 cm.) had been applied. The thermocouples were left in place in order that all readings of cutaneous temperature less than 42.0 C. (107.6 F.) could be recorded. In some instances, readings were continued with the paraffin remaining on the hand for two hours; in other cases the paraffin was removed at the end of a half-hour, and readings were continued until values for basal cutaneous temperature were reached.

1. Martin, G. M.; Roth, G. M., and Krusen, F. H.: Unpublished data.

Moist Heat: Local hot baths were applied to one foot and leg with the subject or patient in the horizontal position. The temperature of the water was maintained at 43 to 45 C. (109 to 113 F.) for thirty minutes. In most of the studies a thin latex rubber sock was placed over the extremity that was being immersed, so that the thermocouples could be left in place on the toes throughout the study and readings of temperature could be made on all the extremities.

Contrast Bath: The contrast bath was applied to one lower extremity, which was placed in a thin rubber sock. The temperatures of the water were 44 C. (111.2 F.) and 15 C. (59 F.). The periods used were four minutes in the hot water followed by one minute in the cold water. The entire bath period was twenty-nine minutes. Temperatures were recorded at five minute intervals until cooling had started; then the usual ten minute interval was used.

Results

Generalized or Systemic Heating. — Cooling curves were determined for 3 patients who received a daily mild hyperpyrexial treatment in a Hubbard tank. The results are shown in table 1 and figure 1. It was noted that oral temperature returned to normal within a half-hour after the person left the bath but the return of the cutaneous temperature of the extremities to basal levels required two to four hours. The cutaneous temperature of each person

TABLE 1. — *Data for Body Cooling of Three Patients After Three Treatments in a Hubbard Tank Given on Successive Days.*

			Temperature, °C.										
							Average Cutaneous						
Subject	Sex & Age, Yr.	Basal Metabolic Rate, %	Oral, at End of Treatment	Rectal Initial	Rectal Final	Rectal Decrease	Initial Toes	Initial Fingers	Final Toes	Final Fingers	Decrease Toes	Decrease Fingers	Duration of Cooling, Min.
1	M28	— 7	37.9	38.2	38.0	0.2	29.3	34.2	25.0	33.1	4.3	1.1	190
			38.1	38.1	37.9	0.2	29.7	35.2	25.9	32.4	3.8	2.8	190
			38.4	38.4	37.9	0.5	31.7	35.1	25.4	31.0	6.3	4.1	170
2	M27	—14	38.1	38.4	37.7	0.7	33.4	35.1	25.6	33.6	7.8	1.5	165
			38.4	38.5	38.0	0.5	32.5	35.6	24.7	32.1	7.8	3.5	160
			38.5	39.3	38.2	1.1	33.7	35.5	26.8	34.0	6.9	1.5	140+
3	M35	0	38.0	38.2	37.6	0.6	32.3	35.2	30.9	27.2	1.4	8.0	150
			38.2	38.2	37.5	0.7	32.4	34.9	29.3	26.1	3.1	8.8	170
			38.6	38.8	37.5	1.3	33.2	35.5	29.3	26.0	4.2	9.5	155

followed approximately the same pattern on three successive days. The time of cooling for the individual was practically the same for each treatment. It became apparent (table 1) that there is a marked variation among persons in the rate of cooling after similar treatments.

In an attempt to determine whether or not the effect on cutaneous temperature of the extremities produced by the mild, dry heat of the baker varied greatly from that of the hyperpyrexial treatments administered in the Hubbard tank or fever cabinet, data concerning 7 persons were collected after the application of heat by each method. The results for 4 normal persons are shown in table 2, for 3 patients with rheumatoid arthritis in table 3 and for 1 patient with rheumatoid arthritis in figure 2. After use of the luminous heat bakers, the return of the cutanous temperature of the extremities to basal levels was only slightly more rapid than that which occurs after use of the Hubbard tank and the fever cabinet.

The characteristics of the cutaneous temperature were roughly parallel and in approximately the same range, irrespective of the method used.

Local Application of Heat. — In table 4 are shown the comparative effects of the local application of heat to one leg of 7 normal persons by means of

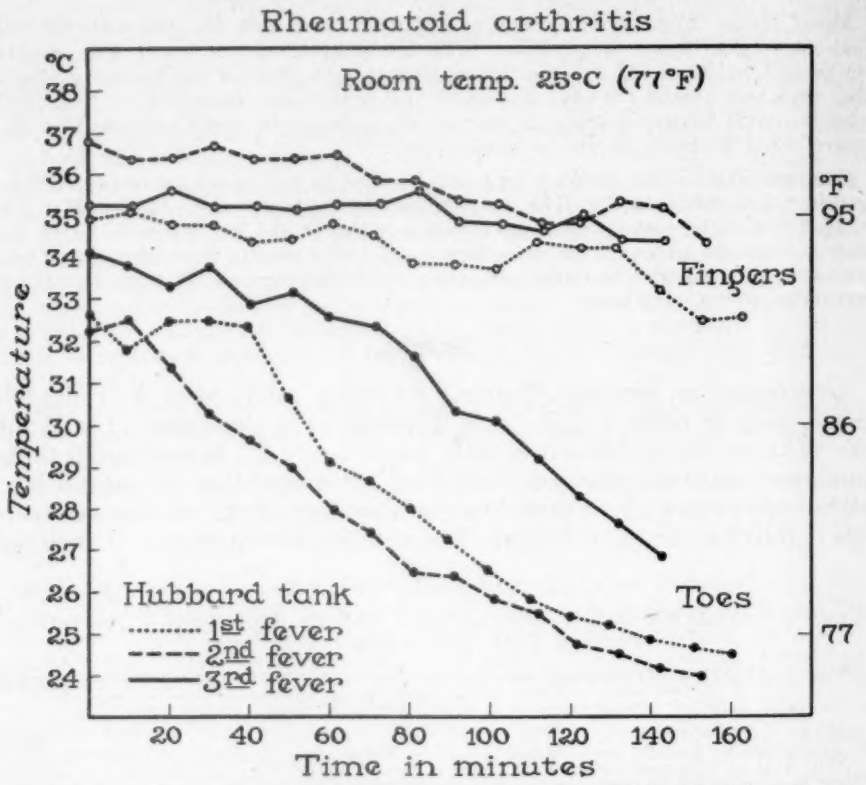


Fig. 1. — The value for cutaneous temperature of the toes and fingers after three successive hyperpyrexial treatments of a patient with rheumatoid arthritis.

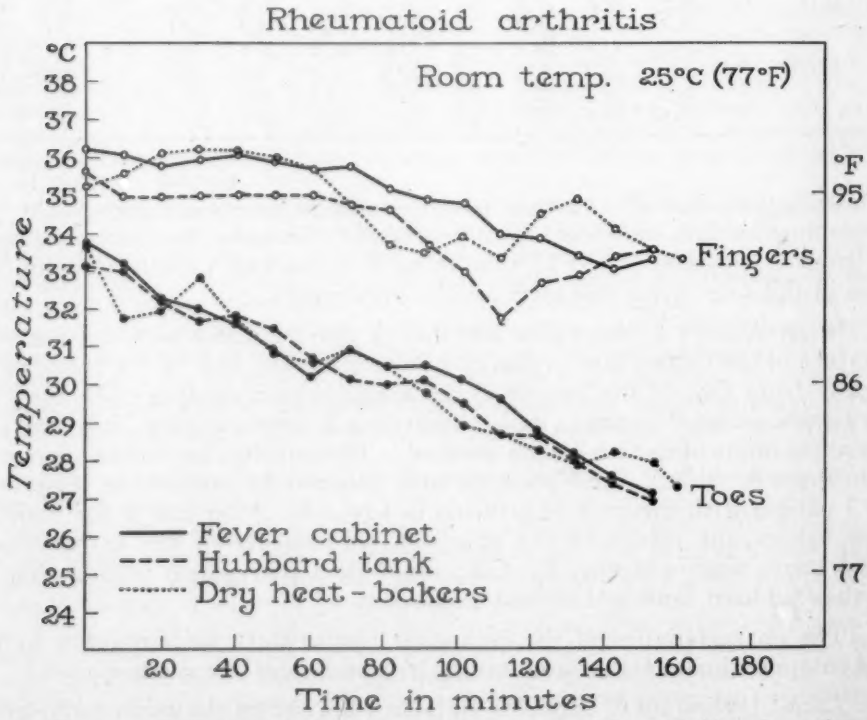


Fig. 2. — Cooling curves of the cutaneous temperature of the extremities of a patient with rheumatoid arthritis, after systemic heating by three methods.

TABLE 2. — *Body Cooling After Use of Three Different Methods of General Body Heating of Normal Persons.*

Subject	Sex & Age, Yr.	Basal Metabolic Rate, %	Method of Applying Heat	Temperature, °C. Oral	Rectal Initial	Rectal Final	Rectal Decrease	Average Cutaneous Initial Toes	Average Cutaneous Initial Fingers	Average Cutaneous Final Toes	Average Cutaneous Final Fingers	Average Cutaneous Decrease Toes	Average Cutaneous Decrease Fingers	Duration of Cooling, Min.
30	F23	+ 5	Hubbard tank	38.4	38.0	37.8	0.2	33.7	34.6	25.4	26.0	8.3	8.6	140
			Fever cabinet	37.3	38.5	38.0	0.5	33.7	34.6	25.4	26.0	8.3	8.6	140
			Double baker	37.6	.....	.....	....	37.1	35.3	26.2	26.6	10.9	8.7	155
31	F24	+ 2	Hubbard tank	38.7	.....	.....	....	33.2	34.3	28.4	29.5	4.8	4.8	160
			Fever cabinet	38.4	.....	.....	....	32.4	34.2	26.0	25.0	6.2	9.2	160
			Double baker	.....	.....	.....	....	31.4	33.0	26.4	23.8	5.0	9.6	135
32	F38	—10	Hubbard tank	38.5	.....	.....	....	32.2	34.8	26.0	27.2	6.2	7.6	235
			Fever cabinet	38.3	.....	.....	....	33.0	33.9	27.0	27.6	6.0	6.3	190
			Double baker	.....	.....	.....	....	34.7	35.5	25.9	27.3	8.8	8.2	160
40	F21	— 6	Hubbard tank	38.4	.....	.....	....	32.9	34.7	23.8	25.1	9.1	8.9	170
			Double baker	37.2	.....	.....	....	32.7	34.0	24.0	24.5	8.7	9.5	105

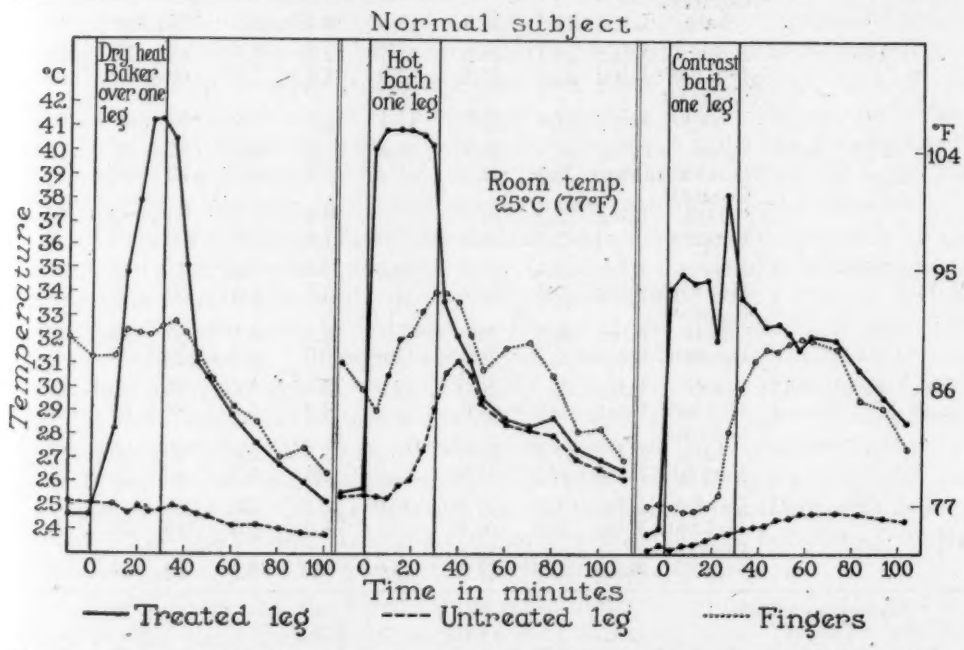


Fig. 3. — The response of the cutaneous temperature of the fingers and toes of a normal person to the local application of heat to one lower extremity by three different methods.

TABLE 3. — *Body Cooling After Use of Three Different Methods of General Body Heating of Patients with Rheumatoid Arthritis.*

Subject	Sex & Age, Yr.	Basal Metabolic Rate, %	Method of Applying Heat	Temperature, °C. Oral	Rectal Initial	Rectal Final	Rectal Decrease	Average Cutaneous Initial Toes	Average Cutaneous Initial Fingers	Average Cutaneous Final Toes	Average Cutaneous Final Fingers	Average Cutaneous Decrease Toes	Average Cutaneous Decrease Fingers	Duration of Cooling to Basal Temperature, Min.
20	F32	+ 4	Hubbard tank	37.7	38.8	38.8	.0	33.6	36.1	26.9	34.0	6.7	2.1	150
			Fever cabinet	38.4	38.5	38.2	.3	32.4	35.7	27.4	33.0	5.0	2.7	150
			Double baker	37.3	.....	.....	....	33.5	35.0	27.9	33.5	5.6	1.5	150
21	F21	—15	Hubbard tank	38.4	38.7	38.3	.5	33.0	35.3	24.2	26.0	8.8	9.3	160
			Fever cabinet	38.5	37.4	37.0	.4	33.3	35.1	23.9	29.6	9.4	5.5	150
			Double baker	37.4	.....	.....	....	29.5	34.4	23.3	30.6	6.2	3.8	120
22	F26	+ 5	Hubbard tank	38.4	.....	.....	....	34.3	34.8	31.3	33.9	3.0	0.9	185
			Fever cabinet	38.3	.....	.....	....	35.1	35.0	30.9	34.0	4.2	1.0	185
			Double baker	37.3	.....	.....	....	34.1	34.9	29.9	33.5	4.2	1.4	170

the dry heat baker, the local hot bath and the contrast bath. In figure 3 the same effects on 1 person are represented. The cutaneous temperature

TABLE 4. — *Effects of the Local Application of Heat on Cutaneous Temperature of Seven Normal Persons.*

Subject	Sex & Age, Yr.	Basal Metabolic Rate, %	Method of Applying Heat	Part Treated	Average Cutaneous Temperature, °C. Basal Toes	Basal Fingers	Increase in Part Treated	Increase in Untreated Parts Toes	Increase in Untreated Parts Fingers	Duration of Effect, Min. Part Treated	Untreated Parts Toes	Untreated Parts Fingers
33	F22	— 6	Baker	R.leg	24.9	31.3	16.5	0.4	1.7	40	5	40
			Hot bath	L.leg	25.6	29.9	16.4	6.4	4.1	70+	70	50
			Contrast bath	L.leg	23.7	28.9	14.8	1.0	2.6	60	60	35
36	F21	— 1	Baker	L.leg	26.3	30.7	17.0+	2.9	3.0	60	60	80
			Hot bath	L.leg	23.4	31.1	18.4	0.0	1.8	65	0	65
			Contrast bath	L.leg	23.6	28.9	13.6	0.4	2.8	105	105	75
37	F36	— 6	Baker	R.leg	25.3	26.1	16.6	2.4	7.7	85	75	85
			Hot bath	L.leg	26.3	27.1	13.9	1.6	5.8	60+	60	60
			Contrast Bath	L.leg	27.4	27.1	11.4	1.3	3.8	40	40	80
34	F18	— 4	Baker	L.leg	22.8	26.3	19.0+	11.5	8.6	75+	75	75
			Hot bath	L.leg	26.8	26.3	.....	6.9	8.0	70+	70+	70
			Contrast bath	L.leg	25.2	27.5	.....	4.9	3.5	90+	90+	90
			Paraffin	R.hand	25.4	26.5	17.0+	1.5	6.7	120	60	120
30	F23	+ 5	Baker	L.leg	28.4	30.9	13.6+	5.1	5.1	45	45	45
			Hot bath	R.leg	29.1	30.7	.....	4.6	4.6	50	50	50
			Contrast bath	R.leg	26.1	28.3	.....	3.3	6.1	50	50	50
			Paraffin	R.hand	25.2	30.4	17.0+	0.0	0.9	120	0	40
35	F21	—11	Baker	L.leg	25.5	26.0	12.8	4.9	7.3	90	70	45
			Hot bath	L.leg	30.0	28.0	.....	4.2	6.2	60+	60	45
			Contrast bath	L.leg	27.7	28.0	.....	3.5	2.4	80+	80+	50
			Paraffin	R.hand	32.3	31.0	10.0	0.4	1.7	40	20	40
39	F23	—25	Baker*	L.leg	23.9	27.2	10.0	0.0	0.0	60	0	0
			Hot bath	R.leg	25.0	25.3	17.1	1.0	6.0	110	70	90
			Contrast bath	R.leg	23.8	25.6	15.0	0.8	0.5	90	20	20

* Baker on low intensity.

of the extremities after the application of heat by means of hot paraffin is included in part of this table. The highest local cutaneous temperature was reached most rapidly with the hot bath and the paraffin bath. When dry heat is applied from the baker, it is often twenty to thirty minutes before the maximal temperature of the part is attained.

The so-called reflex vasodilatation in the untreated parts exhibited marked individual variation. The local hot bath in most instances produced the maximal and most rapid increase in temperature in the untreated extremities, whereas the contrast bath and paraffin bath produced the least.

Local temperature during the contrast bath never approached the cutaneous temperature of the extremities that were being treated with local hot baths given without alternate applications of cold.

In general, after the local application of heat to a part of the body, the temperature of that part returns to basal cutaneous temperature in about half to a third less time than does the temperature of that part after the generalized application of heat.

Comment

In the treatment of rheumatoid arthritis which frequently involves the joints of the hands and feet to a disabling degree, one of the purposes of the use of heat is to improve the circulation. Grant and Holling,[2] Abramson and Fierst[3] and Wilkins and his associates[4] have shown by plethysmographic studies of the hands and feet that the blood flow may amount to less than 1 cc. per minute per hundred cubic centimeters of tissue whenever there is vasoconstriction of the peripheral blood vessels. This condition may exist much of the time in a patient who is suffering from rheumatoid arthritis and who is physically inactive and in an environmental temperature that is not much in excess of 25 C. (77 F.).

The simplest methods of causing vasodilatation around the peripheral joints involve the external application of heat. Since it is generally agreed that an increased blood flow is of value in hastening resolution of inflammation and maintaining adequate amounts of oxygen and nutritional materials for the metabolic needs of the tissue, it is logical to assume that benefit should result from frequent and prolonged states of peripheral vasodilatation.

The results of these studies indicate that general heating of the body results in a considerably more prolonged period of vasodilatation than does the local application of heat. This is in agreement with the conclusion of Ghormley and Silverglade,[5] who found that general heating of the body was more efficient than the local application of heat as a therapeutic measure.

As far as the duration of the elevation of cutaneous temperature of the extremities is concerned, it apparently is wholly immaterial which method of systemic heating is used. It has been demonstrated that a state of peripheral vasodilatation can be obtained by means of the application of mild heat by an electric baker. This vasodilatation lasts approximately as long as that resulting from heating the body to 38.3 C. (101 F.) in a hot humid air cabinet or hot bath, and the treatment itself is better tolerated by weak, anemic and emaciated persons than are the more vigorous forms of treatment.

However, the hot bath provides a method which is easily available and simple to use either in the home or in the hospital physical therapy department. The use of the Hubbard tank makes possible the benefits of underwater exercise, even for patients who are unable to walk.

The degree and duration of the vasodilatation apparently are not influenced by the type of heat, whether it is moist or dry. Osborne and his associates[6] in 1942 stated that there is no further increase in peripheral circulation through the fingers when the rectal temperature is increased to more than 39.9 C. (103.9 F.). Kissin and Bierman[7] and Pinkston,[8] in studying the effects of hyperpyrexia on the peripheral circulation, brought out the fact that general peripheral vasodilatation is almost immediate when external heat is applied but when the fever is induced by foreign protein a period of peripheral vasoconstriction with lowering of cutaneous temperature precedes the vasodilatation and period of dissipation of heat.

---

2. Grant, R. T., and Holling, H. E.: Further Observations on the Vascular Responses of the Human Limb to Body Warming; Evidence for Sympathetic Vasodilator Nerves in the Normal Subject, Clin. Sc. 3:273 (Aug. 15) 1938.
3. Abramson, D., and Fierst, S. M.: Resting Blood Flow and Peripheral Vascular Responses in Hypertensive Subjects, Am. Heart J. 23:84 (Jan.) 1942.
4. Wilkins, R. W.; Doupe, J., and Newman, H. W.: The Rate of Blood Flow in Normal Fingers, Clin. Sc. 3:403 (Dec. 20) 1938.
5. Ghormley, J. W., and Silverglade, A.: Circulation of the Joints of Chronic Arthritis, New York State J. Med. 39:1489 (Aug. 1) 1939.
6. Osborne, S. L.; Markson, D. E.; Driscoll, R. E., and Merriman, J. R.: The Treatment of Arthritis by Electropyrexia Including Some Physiologic Studies During Fever Therapy, J. Lab. & Clin. Med. 27:1135 (June) 1942.
7. Kissin, M., and Bierman, W.: Influence of Hyperpyrexia on Velocity of Blood Flow, Proc. Soc. Exper. Biol. & Med. 30:527 (Jan.) 1933.
8. Pinkston, J. C.: Peripheral Circulation During Experimental Fever, Am. J. Physiol. 110:448 (Dec.) 1934.

Dry heat applied locally by one baker to a part is satisfactory in causing both a local and reflex increase in the peripheral circulation. It is evident from study of the warming and cooling curves of the extremities that the radiant heat baker should be applied with the heat at the maximal intensity that can be tolerated comfortably for twenty to thirty minutes. If lower intensities or shorter periods are used, maximal vasodilatation of the part being treated is not attained. These observations are in agreement with those of Dail and Moor[9] but do not support the conclusions of Uprus and his associates,[10] who stated that the hot air baker was an unsatisfactory method of producing vasodilatation in the extremities. Goldschmidt and Light[11] reported that vasodilatation was not at a maximum until the local temperature of the part treated was 40 C. (104 F.).

The local hot bath has an advantage over the baker in that it makes possible heating of the extremity from all surfaces at the same time. When the local hot bath is employed, maximal temperature of the part is reached sooner than when the baker is used. However, at the conclusion of the thirty minute period of application of heat, the maximal temperature of the part treated is approximately the same when either method is used. The cooling times are more rapid with any form of local heating than with systemic heating, even if the maximal temperature attained with local heating of the part is several degrees higher than that attained with the generalized application.

The work of Woodmansey and his associates[12] showed that the contrast bath, employed with various time periods, does not result in the attainment of maximal vasodilatation of the fingers of the hand being treated in less than an hour. This observation was confirmed by our observations. It appeared that maximal vasodilatation was not obtained even when the short period of one minute's immersion in cold water was alternated with four minutes' immersion in hot water. On the basis of observation of the cutaneous temperature during the local hot bath, it appears that for ten to fifteen minutes' immersion of the part is necessary to attain primary, relatively complete vasodilatation of the vessels of the hands and feet. It would seem, then, that before an attempt is made to "exercise" the vessels by the intermittent application of cold, the vessels should be allowed to relax or dilate nearly to their maximal extent. Thus, the value derived from the use of the contrast bath would be enhanced if the initial period of immersion in the hot water were increased to ten or fifteen minutes. This period should then be followed by alternate immersion of the parts in the hot and cold water, with immersion in cold water being used for one minute out of five for a period of fifteen or twenty minutes.

The experiments carried out with the hot paraffin bath indicate that it still should be considered as a very satisfactory means of applying external heat. Even when the hand coated with paraffin was not kept immersed in the bath longer than for the preliminary coating, it was observed that the cutaneous temperature of the fingers being treated remained at a level which indicated a state of vasodilatation in the hand until the paraffin was removed. After the paraffin was removed, the rate of cooling paralleled that produced by the other methods of local application of heat.

9. Dail, C. W., and Moor, F. B.: Effects of Heat, Cold and Other Stimuli upon Human Circulation, Arch. Phys. Therapy 19:135 (Mar.) 1938.
10. Uprus, V.; Gaylor, J. B., and Carmichael, E. A.: Vasodilatation and Vasoconstriction in Response to Warming and Cooling the Body: A Criticism of Methods, Clin. Sc. 2:301 (Dec.) 1936.
11. Goldschmidt, S., and Light, A. B.: The Effect of Local Temperature upon the Peripheral Circulation and Metabolism of Tissues as Revealed by the Gaseous Content of Venous Blood, Am. J. Physiol. 73:146 (June) 1925.
12. Woodmansey, A.; Collins, D. H., and Ernst, M. M.: Vascular Reactions to the Contrast Bath in Health and in Rheumatoid Arthritis, Lancet 2:1350 (Dec. 10) 1938.

Conclusions

Generalized heating of the body results in a more prolonged vasodilatation in the hands and feet than does local application of heat. The four commonly used methods of the local application of heat (radiant heat baker, local hot bath, paraffin bath and contrast bath) all are satisfactory for causing vasodilatation of the part being treated when these methods are used correctly. Moist and dry heat have essentially the same effect on the cutaneous temperature of the extremities.

III. Effect of Massage on Peripheral Circulation of the Extremities

The use of massage probably dates back to earliest history, when some primitive man unconsciously rubbed a bruised muscle or a sprained ankle. Today, massage is a method of treatment that is being used increasingly and is acquiring a scientific basis with various accepted technics anl definite indications and contraindications for its use. Although the clinical results of massage are undoubted, the specific physiologic factors involved in the achievement of these results have been, and often still are, difficult to determine.

Much of the early investigative work was carried out in Europe during the latter part of the nineteenth century and during the period of development of the Swedish school of physical therapy.

Mitchell,[1] 1894, and Schneider and Havens,[2] in 1915, noted that a temporary increase in the erythrocyte count and the value for hemoglobin followed massage; in some instances these effects followed abdominal massage alone. In 1900 Rosenthal[3] reviewed the previous literature on the scientific basis of massage. He reported that after massage an increase of 2 to 3 C. (3.6 to 5.4 F.) cutaneous temperature had been noted.

Krogh[4] has demonstrated that an increased diameter and increased permeability of the capillaries follow mechanical stimulation of the skin in frogs and mammals. Carrier[5] showed that light pressure on the skin produced an almost instantaneous but transient dilatation of capillaries, whereas heavier pressure resulted in a more enduring dilatation, with a greater number of capillaries being visible. Lange, Ehrich and Cohn[6] in 1930 reported that mechanical stimulation of embryonic blood vessels of the chick, before any nerve supply had developed, caused dilatation.

Pemberton[7], in 1939, reviewed the more recent investigative work on the physiologic effects of massage. He noted that massage seemed to produce

---

1. Mitchell, J. K.: The Effect of Massage on the Number and Haemoglobin Value of the Red Blood-Cells, Am. J. M. Sc. **107**:502 (May) 1894.
2. Schneider, E. C., and Havens, L. C.: The Changes in the Content of Haemoglobin and Red Corpuscles in the Blood of Man at High Altitudes, Am. J. Physiol. **36**:380 (Mar. 1) 1915.
3. Rosenthal, C.: Quoted by Coulter, J. S.: Massage, in Piersol, G. M.: The Cyclopedia of Medicine. Philadelphia, F. A. Davis Company, 1933, vol. 8, pp. 598-617; also quoted by Pemberton.7
4. Krogh, A.: The Anatomy and Physiology of Capillaries, ed. 2, New Haven, Conn., Yale University Press, 1929.
5. Carrier, E. B.: Studies on the Physiology of Capillaries: V. The Reaction of the Human Skin Capillaries to Drugs and Other Stimuli, Am. J. Physiol. **61**:528 (Aug.) 1922.
6. Lange, F.; Ehrich, W., and Cohn, A. E.: Studies on the Blood Vessels in the Membranes of Chick Embryos: Part I. Absence of Nerves in the Vascular Membrane, J. Exper. Med. **52**:65 (July) 1930. Lange, F.: Studies on the Blood Vessels in the Membranes of Chick Embryos: Part II. Reactions of the Blood Vessels in the Vascular Membranes, J. Exper. Med. **52**:73 (July) 1930. Cohn, A. E., and Lange, F.: Studies on the Blood Vessels in the Membranes of Chick Embryos: Part III. Anatomy and Physiology of the Blood Vessels at Different Ages, J. Exper. Med. **52**:81 (July) 1930.
7. Pemberton, R.: (*a*) The Physiologic Influence of Massage, in Mock, H. E.; Pemberton, R., and Coulter, J. S.: Principles and Practice of Physical Therapy. Hagerstown, Md., W. F. Prior Company, Inc., 1932, vol. 1, chap. 6, pp. 1-16; (*b*) Physiology and Massage, in Handbook of Physical Therapy, Ed. 3, Chicago, American Medical Association, 1939, pp. 78-87.

a diuretic effect, especially after abdominal massage, and he suggested that this result might be referable to a direct effect on the muscular tissues, either mechanical or by way of the nervous system. He pointed out that massage had no immediate or delayed effect on the basal consumption of oxygen, the acid-base equilibrium of the blood, the pulse rate or the blood pressure of normal persons. Pemberton,[7a] however, concluded that the cumulative effect which massage exerted on the various metabolic processes probably was due to its mechanical influence on the circulation of the parts concerned.

Clark and Swenson, quoted by Pemberton,[7b] concluded from their work on the capillary circulation in the rabbit's ear that massage is accompanied with or followed by an increased interchange of substances between the blood stream and the tissue cells, with an altered and presumably improved tissue metabolism.

It has been observed repeatedly that, clinically, massage has a definite temporary beneficial effect in reducing edema of the extremities in the presence of cardiac decompensation. The lymph vessels, as well as the blood vessels, probably are affected mechanically by the massage.

Drinker[8] has demonstrated that a definite increase in lymph flow results from massage. Bauer, Short and Bennett[9] demonstrated that proteins injected into the joints of dogs were removed by the lymphatic system and that massage and passive motion definitely increased the rate of elimination of the proteins through these channels. These authors also suggested that any interference with the lymph vessels should promote the formation of intra-articular effusion by blocking the essential apparatus for removal of proteins from the joints.

Procedure

The persons concerned in this study were divided into two groups: 11 normal subjects, 1 man and 10 women, ranging from 21 to 36 years of age, and 24 patients suffering from rheumatoid arthritis. The latter group included 9 women and 15 men, and the clinical status of this group was presented in a separate manuscript arising from the present study.[10]

In the present study, previous to the massage, the subjects had fasted for fifteen hours. During the observations they wore lightweight short pajamas and were in a supine position on comfortable beds. The observations were made in a room in which the temperature was constant at 25.5 C. (78 F.), with a relative humidity of 40 per cent. The temperature of the plantar surfaces of the first and third toes of both feet and the volar side of the distal phalanges of the first and third fingers of both hands was measured by means of copper-constantan thermocouples. After an adequate control period, massage was carried out by a trained physical therapist who employed a modified Hoffa type of deep stroking (effleurage) and kneading (pétrissage). Massage was started at the proximal portion of the extremity and completed at the distal part. Thermocouples were removed only during massage of the fingers and toes. A light liquid petrolatum was used as the lubricant. Massage of each extremity lasted between five and ten minutes.

The routine followed for massage of the leg began with stroking of the entire leg. The quadriceps femoris, or anterior group of muscles was massaged in three divisions beginning with stroking; then finger pétrissage was done, followed by one hand pétrissage. Stroking completed treatment in this area. The outer group, or abductors, were then massaged. This was followed by stroking and pétrissage of the adductors, hamstrings, knee, anterior group of muscles of the lower part of the leg, outer group (peroneals), posterior group (gastrocnemius) and foot. Massage of the leg was completed by two hand stroking of the entire leg.

The routine used for massage of the arm began with two hand stroking of the entire arm. The deltoid was stroked; finger pétrissage and one hand pétrissage was then done in three

8. Drinker, C. K.: The Formation and Movements of Lymph, Am. Heart J. 18:389 (Oct.) 1939.
9. Bauer, W.; Short, C. L., and Bennett, G. A.: The Manner of Removal of Proteins from Normal Joints, J. Exper. Med. 57:419 (Mar.) 1933.
10. Martin, G. M.; Roth, Grace, M., and Krusen, F. H.: Unpublished data.

divisions, and then two hand stroking completed this massage. Next, stroking and pétrissage of the triceps was done in two divisions. This was followed by stroking and pétrissage

Effects of Massage on the Cutaneous Temperature of the Extremities: Ten Normal Persons and One Patient (No. 11).

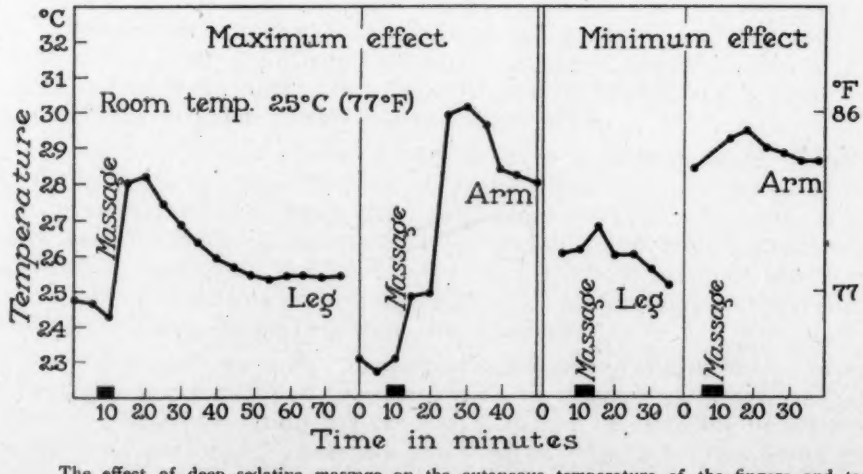
Subject	Sex & Age, Yr.	Basal Metabolic Rate, %	Part Massaged	Average Cutaneous Temperature, °C. Initial	Final	Increase	Duration of Effect, Min.	Part Massaged	Average Cutaneous Temperature, °C. Initial	Final	Increase	Duration of Effect, Min.
33	F22	— 6	R.leg	23.5	25.8	2.3	25	L.arm	23.7	25.6	1.9	30
			L.leg	23.2	25.5	2.3	15					
36	F21	— 1	R.leg.	22.9	25.0	2.9	35	R.arm	22.8	30.1	7.3	40
			L.leg.	23.0	25.8	2.8	25					
37	F36	— 6	R.leg	25.5	26.8	1.3	40	R.arm	26.1	28.3	2.2	30
			L.leg	25.1	26.2	1.1	35	L.arm	25.2	26.6	1.4	25
39	F23	—25	R.leg	26.1	27.9	1.8	20	R.arm	26.9	29.8	2.9	25+
			L.leg	25.2	26.4	1.2	20	L.arm	27.4	30.0	2.6	30+
32	F36	—10	R.leg	27.8	28.6	0.8	25	R.arm	29.6	32.1	2.5	25+
			L.leg	27.8	28.4	0.6	25					
40	F21	— 6	R.leg	26.0	26.4	0.4	20	L.arm	24.4	27.5	3.1	45+
			L.leg	24.8	28.4	3.6	45					
31	F24	+ 2	R.leg	24.7	26.6	1.9	35	R.arm	26.3	28.4	2.1	40
			L.leg	24.7	26.6	1.9	35					
30	F23	+ 5	R.leg	24.4	26.7	2.3	25	R.arm	25.4	29.6	4.2	20
			L.leg	24.3	26.2	1.9	15	L.arm	23.9	27.8	3.9	20
35	F22	—11	R.leg	29.8	31.4	1.6	80+	R.arm	28.4	29.5	0.9	30
			L.leg	27.6	29.4	1.8	80+	L.arm	27.2	29.6	1.6	40
11	M19	+10	R.leg	26.2	27.0	0.8	15	R.arm	27.2	34.3	6.9	90+
			L.leg	25.2	27.4	2.2	35					
34	F18	— 4	R.leg	24.0	24.9	0.9	20	R.arm	26.1	26.8	0.7	15

of the elbow, forearm, hand and fingers. Massage of the arm was completed by two hand stroking of the entire arm.

The subject remained relaxed and in the supine position throughout the procedure. Readings of cutaneous temperature were made every five minutes. Observation was continued after the massage, until the cutaneous temperature of the extremities had reached the previous basal level.

Results

The effects of massage on the cutaneous temperature of the extremities of 10 normal persons and 1 patient with chronic rheumatoid arthritis (patient



The effect of deep sedative massage on the cutaneous temperature of the fingers and toes of normal persons when administered under controlled conditions.

11) are shown in the table. The effects of deep sedative massage on the cutaneous temperature of the fingers and toes are seen in the figure. In every instance, after massage of an extremity, there was some increase in the cutaneous temperature of this extremity, and the increase lasted from fifteen to more than ninety minutes. In the toes the increase was from a minimum of 0.4 C. (0.72 F). to a maximum of 3.6 C. (6.5 F.). In the fingers the changes varied from an increase of 0.9 C. (1.6 F.) to one of 7.3 C. (13.1 F.). In 1 normal person and in the 1 patient who had chronic rheumatoid arthritis the increase in the cutaneous temperature of the fingers was 7.3 and 6.9 C. (13.1 and 12.4 F.), respectively. This may be explained by the low basal temperature of the fingers. During the massage an increase in temperature in another extremity was noted only once. Massage of the backs of 3 persons was done; no change in the cutaneous temperature of the extremities of these persons was noted. Furthermore, a coating of liquid petrolatum over the extremities, without massage, had no effect on the skin temperature of the fingers and toes.

Comment

Rosenthal had reported earlier that an increase in cutaneous temperature followed massage. On the basis of our study it is evident that massage alone will cause some increase in the cutaneous temperature of the extremities. In most cases, it is impossible to determine how much of the increase in cutaneous temperature is due to mechanical effects on the blood flow and how much is due to reflex stimulation. In the persons who exhibited considerable elevation of cutaneous temperature after massage vasodilatation probably was caused by a reflex mechanism. This marked increase was noted only in persons who had a normal basal metabolic rate and who also exhibited a rapid increase of cutaneous temperature in response to a warm environmental temperature.

Conclusions

Massage of the extremities results in varying degrees of elevation of the cutaneous temperature. This is probably due to an increased blood flow through the parts being treated. The duration of elevation of the temperature is less than that which occurs after any form of heating.

THE CHALLENGE OF CRUTCHES

VI. Living with Crutches and Canes

GEORGE G. DEAVER, M.D.
Medical Director, Institute for the Crippled and Disabled
and
MARY ELEANOR BROWN, M.A.
Physical Therapy Technician, Institute for the Crippled and Disabled
NEW YORK

Is it worth it? Boys and girls, men and women of all ages and all degrees of disabilities are daily struggling to lace complicated corsets and buckle on long double ankle-stopping, knee-locking, hip-locking braces on pelvic bands, straining to their unsteady feet and gradually learning the arduous step by step routine of crutch manipulation. Add to this, in the case of many with injuries of the spinal cord, the necessary bladder precautionary measures, such as voluminous padding or urinal bags, and the human being begins to resemble a curious new species. On a cold, brisk winter day, some warmth may be gained by this apparatus, but the mere thought of heavy corset material and brace leather and metal against the perspiring skin in the heat of a summer day is likely to subdue the enthusiasm of the most ardent proponent of rehabilitation. Teachers of the disabled are confronted by the question, "Is it worth it?" often asked by others, sometimes by the teachers themselves. Is it a waste of the teachers' time? Is it a waste of the student's time? Would it not be better to prepare severely disabled persons for life in a wheelchair?

This is a matter involving the most fundamental values of life. It cannot be answered in general. It must be answered in particular for each individual. It cannot be answered by physician or the teacher; it must be answered by the disabled person himself.

The response of most so-called normal people to the possibility of suffering a "stroke" or a spinal cord injury from an automobile accident or any severe illness or accident is usually a forceful "I'd rather die!" Many of the severely disabled persons would gladly join in the horrible plan of a fiery ex-truck-driver "to line us comedians up against a wall and use a machine gun." Society is not run that way. Maybe it should be, but it is not. No person has that choice. But there is another choice, and it is up to us to see that the disabled person has this other choice.

The basic principle of our American lives is independence. However hollow this term may be in the last analysis, when it can be shown to count for little, nevertheless in one's daily life independence in the form of being able to care for personal needs, such as dressing and undressing, walking and traveling and using the hands in everyday tasks, becomes the envy of many a person suddenly struck down in some unforeseen manner and deprived of the ability to be personally independent.

There are available simple instruments for testing and technics for teaching the daily life activities to persons with all degrees of disabilities. One of these is a scale for rating the physical demands of daily life of orthopedically disabled persons.[1] There are thirty-seven daily activities listed under

1. Deaver, George G., and Brown, Mary Eleanor: Physical Demands of Daily Life: Scale for Rating the Orthopedically Exceptional, New York, Institute for the Crippled and Disabled, 1945.

the headings of (1) locomotion and traveling activities, (2) self-care activities and (3) hand activities. This test is satisfactory when the subject can walk to some degree. However, in the case of a person in bed or wheelchair enough information cannot be gained from it. The locomotion and traveling activities cannot be performed, and there is no way to estimate the subject's ability to handle himself in daily life in bed or wheelchair, nor is there means to judge his potentialities for walking and traveling. A new list of daily activities, eighty-two in number, is being formulated with estimated time limits, and is given in the accompanying rating scale.

Physical Demands of Daily Life from Bed to Job

A Graphic Scale for Rating the Orthopedically Exceptional and Recording Their Progress *

Nonwalking Activities

I. Bed Activities
1. Moving from place to place ..... 40 sec.
2. Changing position ..... 80 sec.

II. Dressing and Undressing Activities
3. Putting on clothing except for tying shoestrings and necktie ..... 1 min.
4. Tying shoestrings ..... 1 min.
5. Tying necktie ..... 1 min.
6. Taking off clothing ..... 10 min.
7. Putting on braces ..... 15 min.
8. Taking off braces ..... 15 min.

III. Toilet Activities
9. Motions of combing or brushing hair ..... 10 sec.
10. Motions of brushing teeth ..... 10 sec.
11. Motions of shaving or putting on make-up ..... 10 sec.
12. Motions of washing two extremities ..... 20 sec.
13. Manipulating bed pan or equivalent, if any ..... 30 sec.
14. Putting on bladder apparatus, if any ..... 2 min.
15. Taking off bladder apparatus, if any ..... 1 min.

IV. Eating and Drinking Activities
16. Motions of cutting meat ..... 10 sec.
17. Motions of eating with fork ..... 10 sec.
18. Motions of drinking ..... 10 sec.

V. Desk Activities
19. Communicating on paper ..... 1 min.
20. Opening envelope, removing and unfolding paper ..... 20 sec.
21. Drawing straight line with ruler on paper just unfolded ..... 20 sec.
22. Cutting along line with scissors ..... 30 sec.
23. Folding paper, placing in envelope and sealing envelope ..... 30 sec.
24. Opening and closing drawer ..... 10 sec.
25. Turning on and off light ..... 10 sec.
26. Using dial telephone ..... 30 sec.

VI. Wheelchair Activities
27. Bed to wheelchair ..... 1 min.
28. Wheelchair to bed ..... 1 min.
29. Raising and lowering footrests ..... 20 sec.
30. Propelling wheelchair forward 30 feet and stoping ..... 10 sec.
31. Propelling wheelchair backward 30 feet and stoping ..... 15 sec.
32. One revolution in each direction ..... 20 sec.
33. Opening and closing door in wheelchair and return ..... 2 min.
34. Wheelchair to chair ..... 1 min.
35. Chair to wheelchair ..... 1 min.
36. Wheelchair to toilet ..... 1 min.
37. Toilet to wheelchair ..... 1 min.
38. Wheelchair to bathtub ..... 1 min.
39. Bathtub to wheelchair ..... 1 min.

* One of us (G. G. D.), as consultant for the Veterans Administration, has used seventy-one items of this test in the following publication of the Department of Medicine and Surgery of the Medical Rehabilitation Division of the Veterans Administration: What's My Score? Handbook for Patients with Disabilities Resulting from Spinal Cord Injuries, Veterans Administration, pamphlet 10-10, 1946.

40.	Wheelchair to automobile	1 min.
41.	Automobile to wheelchair	1 min.
42.	Wheelchair to floor	1 min.
43.	Floor to wheelchair	1 min.
44.	Moving on floor in other than upright position 30 feet	3 min.
45.	Ascending three stairs without braces and crutches	2 min.
46.	Descending three stairs without braces and crutches	2 min.
VII.	Standing Activities	
47.	Locking braces	1 min.
48.	Maintaining standing position upright with support, not crutches	1 min.
Walking Activities		
1.	Progressing Activities	
49.	Walking forward 30 feet	15 sec.
50.	Walking backward 10 feet	15 sec.
51.	Walking sideward to each side 10 feet	15 sec.
52.	Opening and closing door, erect, and return	1 min.
II.	Climbing Activities	
53.	Up 15 degree ramp, 3 feet	1 min.
54.	Down 15 degree ramp, 3 feet	1 min.
55.	Up 3 standard steps, one hand rail	1 min.
56.	Down 3 standard steps, one hand rail	1 min.
57.	Up 3 standard steps, no hand rail	1 min.
58.	Down 3 standard steps, no hand rail	1 min.
59.	Up curb	5 sec.
60.	Down curb	5 sec.
61.	Up bus step	10 sec.
62.	Down bus step	10 sec.
Elevation Activities		
63.	Bed to erect position	1 min.
64.	Erect position to bed	1 min.
65.	Wheelchair to erect position	1 min.
66.	Erect position to wheelchair	1 min.
67.	Unlocking braces	1 min.
68.	Chair to erect position	1 min.
69.	Erect position to chair	1 min.
70.	Toilet to erect position	1 min.
71.	Erect position to toilet	1 min
72.	Automobile to erect position	1 min.
73.	Erect position to automobile	1 min.
74.	Down on floor	1 min
75.	Up from floor	1 min.
76.	Picking up package from floor and carrying it 20 feet	2 min.
Endurance Activities		
77.	Maintaining sitting position 3 hours	3 hrs.
78.	Walking forward 300 feet	5 min.
79.	Keeping braces on 10 hours	10 hrs.
Traveling Activities		
80.	Crossing standard street on green light.	
81.	Traveling one mile by standard vehicle	
82.	Driving car.	

The test is divided into nonwalking, walking, elevation, endurance and traveling activities. All are self explanatory except the elevation activities, which comprise acts involving raising and lowering the body from one level to another, such as getting to an erect position from a wheelchair.

The record is kept by means of a silhouette in the form of a long narrow sheet of paper lined so as to form one numbered block to correspond with each activity. Each block is filled in when the activity can be accomplished. Thus the silhouette becomes not only a test as of a specific entrance date

represented by the filled-in black blocks, but also a progress report as shown by the filled-in red blocks.[2]

The list of activities may be placed on any standard bulletin board and silhouettes thumb-tacked up in place with the numbered blocks matching the numbered activities on the list. The motivating properties of such a graphic record prove of great value in a daily activity rehabilitation program.

This new test is for any disability regardless of the condition. It is being used successfully for all types of cerebral palsy, poliomyelitis, multiple sclerosis, spinal cord injuries and amputations.

Once a daily activity inventory of a disabled person has been taken then a program can be made for him, and methods[3] for performing the activities he has been unable to perform on the test may be taught him.

Every disabled person has the. right to such a daily activity inventory. Many a disabled person has had his eyes opened to what he can and cannot do. No amount of guessing will tell this. The test must be performed in its entirety. Many interesting incidents could be related of acts achieved on this test which the subject never dreamed he could do, yet when presented with the circumstances he performed them.

More than that, each disabled person is entitled to an acquaintance with all the methods known to help him learn these daily activities. The disabled person should be encouraged to undertake daily activity rehabilitation over a trial period of at least six months, so that he will be in a position to evaluate it and make his judgment as to whether to continue or not.

It is after such a trial period that the matter of choice comes in. The disabled person knows how much effort and time it takes; he knows where his interests lie, and he must make the decision. There are medical reasons why a great many disabled people should continue their orthopedic rehabilitation. Exercise induces circulation and better functioning of the whole organism; bed and wheelchair confinement encourages the dreaded pressure sores and kidney stones of persons with spinal cord injuries, to say nothing of the wasting of unused muscles, normal and impaired, and the muscle contractures and the joint rigidity which result from fixed positions and bring about deformities. There may also be medical reasons why the disabled person should not take up rehabilitation. These are not clear at present but will be revealed with time and may include overstretched ligaments, muscles and nerves causing pain; joints injured by jarring, poor body alinement imposed by the disability and too great pressure and strain; internal organ displacement due to lack of abdominal support, natural or otherwise; circulatory difficulties due to the lack of proper circulation to extremities.

We have examples of people who have gone on in the face of the most insurmountable difficulties, as well as those who have stopped to resume a wheelchair life. One woman with a mid-dorsal spinal cord injury who had worked for a number of months and was about to give up, asked for the "cards to be put on the table." Once again the therapist urged her to get a corset and said if she would spend four hours every day she could learn to walk on crutches and do some of the daily activities. Being a writer, she did not like to give up so much time in addition to that required for her personal care which was already time consuming. She thought it over and returned in two months, ordered a corset and resumed rehabilita-

2. If at the time of initial testing an activity can be performed within the time designated, the whole block is filled in in black; if the activity can be performed only within twice the allotted time, the block is only half filled in in black; if the activity cannot be performed in twice the allotted time or at all, the block is left blank. If after training the activity can be performed within the time allowed, the whole block is filled in in red and dated; if the activity can be performed within twice the allotted time, the block is half filled in in red and dated. Thus, if at the time of initial testing the activity can be performed only within twice the allotted time and after training it can be performed within the allotted time, the record will show a black half block and a red half block (the latter dated). It is obvious that the block could be completely filled in in red and bear two different dates.

3. Deaver, George G., and Brown, Mary Eleanor: The Challenge of Crutches: V. Daily Activities on Crutches, Arch. Phys. Med. 27:141-157 (March) 1946.

tion. She says that she feels better while she is exercising and is "more alive."

A man of intelligence and character spent one year doing nothing but rehabilitating himself in daily activities, and no one could have been more intelligent, conscientious or enthusiastic about his program. He is now living a wheelchair life, making over $5,000 a year running his magazine business, which takes all his time and yet enables him to support his wife and child.

A red-haired beauty of 17, with white skin and violet eyes, made a valiant and successful attempt at rehabilitation for five months. She went back to school, and now, in order not to make her many friends wait while she plugs along on crutches, she speeds to the corner drugstore in her wheelchair.

Neither business man nor beauty should be condemned for the choice made. Both know what it's like. They tried. They have made their choice. That is their right. It is our duty to make it possible for them to make this choice.

A. Conditioning for Living with Crutches

If the decision is made in favor of the relatively independent ambulatory life, then actually living with corsets, braces and crutches or canes or a combination of these, day in and day out, till they are taken for granted, must be achieved by a process of conditioning.

1. *Crutch-Walking Is Exercise.* — Crutch-walking is a skill, and practice, strength and endurance are required to retain it. Crutch-walkers get out of practice easily and lose their strength if they do not continually do balancing and walking exercises daily on a regular schedule. The more gaits that are known and practiced the more extensive will be the exercise, since each gait makes different demands on the subject. Any gait that the subject can do should be done as an exercise, even though it may turn out to be much too slow for practical walking purposes. Therefore, in the case of spastic paraplegia if there is any possibility that the lower extremities can be moved, the four point alternate gait should be taught. Experience shows that this may prove to be a very slow gait, but, as has been said before, as an exercise it is most beneficial. If the subject does attain a certain degree of efficiency in the four point alternate gait, then he should be put on the two point alternate gait. The swinging through gait, however, remains the fastest one and, whenever this is possible, should be taught to all disabled persons.

For subjects with distorted backs, spinal fusions and deformed rib cages, with their accompaniment of cramped internal organs, the swinging gait may be a very relieving exercise, since, when the weight of the body is on the shoulder girdle and upper extremities, the trunk and lower extremities may hang and be elongated further by the pull of gravity.

2. *Conditioning for Endurance.* — Too many crutch-walkers are satisfied once they have learned to balance themselves and to walk. They are content to hobble and struggle around from room to room whenever this becomes necessary, and they have to sit down to rest often. If crutch-walkers want to be hired for jobs, they need enough endurance to be able to move around all day without the necessity for long rest periods after every slight exertion. This means that a "conditioning" program must be followed. The example of Gerald H. illustrates the best procedure for learning how to develop endurance to last through a full day's work.

Gerald H. is a young man of 26, severely disabled by infantile paralysis. After spending nineteen years in a wheelchair, he became rehabilitated with the aid of braces, crutches and special shoes to the point where he could walk and travel, sit down and get up from a seat, climb stairs, move from room to room and, in fact, perform all necessary daily activities. He pro-

cured a position, only to make the discovery that he had not the physical stamina to endure a full day's work. It was necessary for him to undertake a period of gradual conditioning to accustom himself to the hours required by a full-time position. He began his conditioning schedule by arriving at eleven and leaving at one o'clock, with a rest period after lunch. He gradually increased his working day until he reached a point where he could spend the full day at work with no more than a normal amount of fatigue.

Inability to walk distances may either keep a subject from a job or make it necessary to spend large sums of money daily on taxi fares. The case of Thomas L. illustrates such a difficulty and how it was overcome.

Thomas L., with long double-leg braces, a back brace and crutches, learned to walk and to enter and leave buses and street cars, but he did not have enough strength to walk the few blocks between his home and the bus stop. This meant he had to take a taxi to and from his work. He was given conditioning exercises and a program of walking during which the distances were increased as he became stronger. In two months he was able to walk the distance between his house and the bus stop.

3. *Calisthenics for Crutch-Walkers.* — It has been traditional to believe that disabled subjects should not exert themselves, whereas in many cases a high degree of efficiency could be developed by working on the parts of the body that are not disabled or are less severely so. It has been traditional also for therapists to spend many hours working on disabled parts, even though many times there is little chance of ever restoring them.

The best premise is to assume that all activities are possible until they are demonstrated to be impossible, the latter contingency being rather rarer than would be imagined.

Most disabled subjects need exercise. They feel better after it for physiologic reasons. They become stronger in parts that they never dreamed could become stronger. They learn to manipulate themselves skilfully in many different circumstances which require many varied movements. This ability is reflected in the way they move around and in the increased certainty, confidence and speed that they acquire in all activities.

The importance of repeating over and over all the daily activities under as many varied conditions as possible cannot be too greatly urged. However, since this procedure can become tedious and boring, we are including here a number of additional exercises which can be done in bed or on mats, on parallel bars and with crutches and which may or may not be done in groups. These may not all be directly associated with a particular crutch gait or other crutch activity, although many of them could be justified on that basis. Some of the general exercises unrelated to crutches serve the particular function of maintaining general body tone. When one considers the many and varied movements possible at the shoulder, elbow, wrist and finger joints, it is evident that the limited number of movements needed to move the crutches and body forward are not adequate to meet the muscular needs of the subject. The crutches, in effect, act as splints and tend to prevent trunk and upper extremity movements. Therefore, exercises employing the non-crutch-walking muscles may be used to great advantage.

Appendix I contains a list of bed or mat exercises, parallel bar exercises and crutch exercises which are patterned after the style of the exercises described in a previous article.

B. The Use of Canes

A cane is really a short crutch, about the length of a lower extremity, which therefore cannot be used under the arm. For this reason the control of the cane must be entirely with the hand. The common standard cane is 36 inches. Usually any size other than 36 inches must be adjusted or made

especially. A cane should be strong and contain a good large soft rubber cap for its base, such as has already been described for crutches.[4]

Since crutches go under the arms, they support the upper extremities and trunk. A cane provides much less support for weight and can be used only for the lesser degrees of disabilities. Canes are more difficult to use than crutches. Often it is necessary to teach subjects how to use crutches before they are put on canes.

The use of canes rests on the extent of the disability. Actually the secret to the understanding and selection of a cane method lies in an intimate study of the muscular and articular limitations. So far this has not been done, and these notes are meant only to draw attention to such a need.

Canes aid in weight bearing and balance. If a cane is needed chiefly for weight bearing when one lower extremity is disabled, then it is carried on the side of the disability. The hand holds the cane next to the extremity and, with stiff elbow, moves it forward with the extremity. When weight is borne on the disabled extremity, the subject carries the normal weight which would be distributed to this part on the cane and hand and thus strives for a symmetric gait. The distribution of weight on cane and hand is dependent on the weight which can be taken by the disabled extremity. When two canes are used for weight bearing, two extremities are supposedly disabled and the same technic prevails. This use of canes is not a desirable practice, as it places a great strain on the upper extremities and the subject's hands are usually blistered or have thick calluses. Such persons should rightfully have knee braces to prevent buckling of knees, since they are usually suffering from weak quadriceps muscles.

The principal justification for a cane is to maintain balance. The cane is carried in the hand opposite to the disabled limb. Each step is taken with the idea of throwing more of the weight on the better side with the cane, thus relieving the disabled part from the burden of normal weight-bearing as well as serving to catch balance. This combination of cane and disability obviously leads to a limping gait, since more weight will be continually taken on the better side. The subject will thus lean more toward that side. Whenever he steps on the disabled extremity, he will do so lightly, quickly transferring as much weight as possible to the cane side and insuring his balance with the cane. The cane should be of such a height as to allow a bend at the elbow of approximately 30 degrees with the vertical, inasmuch as the cane is carried away from the body and this height allows the greatest power to be drawn from the participating muscle groups. The person using this method no doubt began by using two crutches and a three point gait, later discarded one crutch and now replaces his crutch with a cane.

When two canes are used, they are handled similarly to crutches, although they are not so valuable for weight bearing as they are for balance. If two canes are necessary, it is likely that the subject is disabled in both lower extremities. He should take a step with one cane and then step with the other foot, following it by stepping with the second cane and finally with the foot on the opposite side to that cane. This is a four point gait. This gait may be accelerated and one cane and the opposite foot placed on the floor at the same time, followed by the other cane with the other foot. This is a two point gait.

Canadian crutches[5] are extended canes. They have their devoted users. The feature which makes them different from canes is their support above the elbow. Canes are used by people who have good control of trunk, pelvis and upper extremities, and this should be the case with Canadian crutches. But the devoted Canadian crutch users of our acquaintance have so far with

4. Deaver, George G., and Brown, Mary Eleanor: The Challenge of Crutches: Methods of Crutch Management, Arch. Phys. Med. 26:397-403 (July) 1945, p. 401.
5. Deaver, and Brown,4 p. 400.

out exception been those who have much greater weaknesses than of the triceps muscles and impairment of the lower extremities. Boys and girls, one-time respirator patients, extremely disabled all over the body, corseted and braced from top to bottom, come struggling in on Canadian crutches. These should be promptly taken away from them with no arguments. The standard underarm variety of crutch is imperative for them because of its trunk support. With trunk weakness, Canadian crutches will fail their users in many daily activities, particularly opening and closing doors, going up and down stairs and curbs and getting up from chairs and floor. The reason for this is as follows: When a hand is needed, it must be taken off the crutch. This is hazardous in case of trunk weakness, because there is no way of supporting the trunk once the hand is released from the crutch.

Another disadvantage of Canadian crutches is that they do not allow the person a chance to rest on his armpits and thereby relax his hands. The hands must be on full duty all the time the crutches are being used. Crutch walkers should be taught to "walk on their hands" but rest on the armpits.

The additional above the elbow supports in the form of small metal pieces at strategic points, found on some Canadian crutches, should be added to the underarm variety of crutch when triceps weakness is a difficulty.

It is our firm conviction that only in exceptional cases are Canadian crutches appropriate to meet the needs of disabled people in performing activities essential to daily living and working.

C. Progress Reports

The silhouette method of recording progress in learning daily activities has already been described (p. 686). These everyday activities represent the big milestones in daily activity rehabilitation. In addition, there are literally hundreds of intermediate landmarks along the way to learning each big activity. Therefore, progress records of smaller achievements should be kept. This may be done each day or at suitable intervals, in case improvement is so slow that daily progress would not be great enough to be recognized. Steps should be counted, distances measured and accomplishments timed. Graphs may be kept,[6] and the subjects themselves may be taught how to make these. Some of the items which can be graphed are the following:

A selected gait performed to the fatigue point, distance covered and time necessary
Length of time possible to stand with one crutch raised off floor
Number of swing-to's, distance covered and time necessary
Number of swing-through's, distance covered and time necessary
Number of times subject can move crutches forward and backward while standing in one place and time necessary
Length of time it takes a subject to walk 100 feet

A sample of a stair-ascending and stair-descending graph is shown in figure 1.

Up to and including June 12, 1946, the subject received eighty-nine two-hour rehabilitation instruction periods. During his thirty-sixth period, stair-climbing was tried and found impossible. It was attempted again during his fiftieth period, with no better results. During his fifty-second period he went up seventeen steps, to top this during his sixty-second period by four steps. Then his record went down to seventeen for a while. During his eighty-seventh period he achieved twenty-four steps and during his eighty-ninth period forty-four steps.

Stair-descending has been more difficult. He could not do this at all

6. Phelps, W. M.: Evidences of Improvement in Cases of Athetosis Treated by Re-Education: The Use of Graphs as Measurements, A. Research Nerv. & Ment. Dis., Proc. 21:529-533, 1942.

until his eighty-third lesson when he descended seven steps. During his eighty-seventh period he descended sixteen steps. Before this accomplishment, his trunk needed to be held while he raised his body to clear the ground. It was then necessary for some one to move his feet to clear the step.

The next graph will be to time him on going up a given number of steps.

It is of interest to realize that the management of stairs for this subject looked hopeless for some time before it was accomplished. He is 72½ inches tall and weighs 166¼ pounds. He has no abdominal muscles. He has footplates inside his shoes, which make the braces heavier (the braces weigh 12¼ pounds). With straight elbows his hands rested on the banister, which

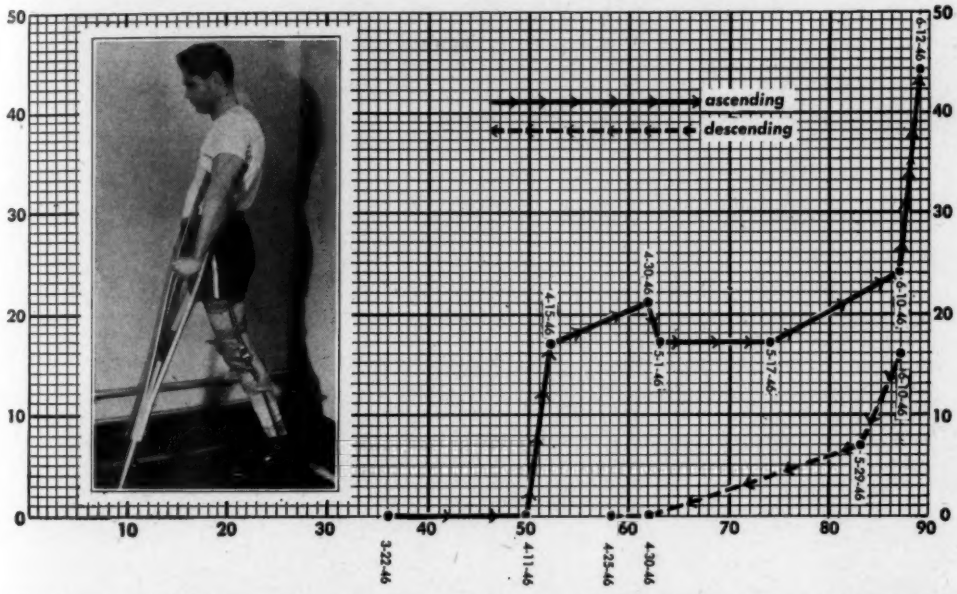


Fig. 1. — Graph of stair ascending and stair descending. The subject, a 34 year old man, had sustained an injury to the spinal cord at the midthoracic level, with resulting spastic paraplegia, absence of abdominal muscles and partial incontinence. The appliances worn are long double knee-locking leg braces on a pelvic band, with foot plates; corset; two crutches and high shoes. The daily activity test was given Jan. 28, 1946; daily two hour rehabilitation instruction periods were begun on January 29. During the stair instruction periods two therapists were present, for safety only. They did no major work. The vertical scale represents the number of 8 inch steps with overhanging lips and 37 inch banister. The horizontal scale represents the number of two hour rehabilitation periods. Mr. Irving Wolinsky granted permission to use part of his record.

was too low to allow him to lift himself upward sufficiently. His feet caught on the overhanging lips of the steps and prevented him from raising his body farther in attempting to ascend the stairs. Stair-descending appeared impossible. The whole project seemed futile. The lesson to be learned is to keep trying. All the individual's resources must be brought to the task over and over again, and if they are of good quality the insurmountable will be surmounted.

It should be added that it will be some time before this subject is tested on ascending and descending stairs entirely by himself with no one around to protect him, and thus earn a red mark on his silhouette. The graph serves as an easy record-keeping instrument and a valuable intermediate motivating device not only for him but also for others. The daily activity silhouette records the larger milestones on the road to rehabilitation.

D. How to Help and How to Hinder the Disabled Person

In instructing orthopedic rehabilitation, one of the most baffling problems is to know and explain when not to help a disabled person and when to help him and how.

In order to simplify the subject, we are listing a number of positive versus negative items:

DO'S	DON'TS
1. When a disabled person on crutches loses his balance,	
attempt to catch him by placing the hands firmly on the pelvis before steadying him.	never touch his crutches, his upper or lower extremities, his waist. His crutches and extremities he needs to control himself.
2. When a severely disabled person loses his balance,	
the job at hand is often to get the pelvis forward. The person behind should direct the pelvis forward while the person in front pushes the chest backward, so that the head is thrown back and the subject does not jack-knife backward.	do not grab him in such a way that he bends forward at the hips, for he cannot assume an erect position by himself from this position.
3. When a disabled person falls,	
allow him to stay where he is for a few minutes. Ask him if he is injured. If he complains of injury, examine the part carefully, and if there is any doubt have him remain on the floor until a doctor can be summoned or first-aid measures applied and the subject taken to the physician.	do not immediately give him a pep talk to try to get up by himself. Do not immediately help him to arise. Serious consequences have occurred by over-zealous disabled people who have tried to get up after falling. Some have impaired sensation and will not feel the usual pain resulting from fractures.
4. In teaching a severely disabled person to walk and travel,	
there needs to be a team of at least two persons, one in front and one behind him. The one in front should give the instructions; the one behind remains a silent assistant for the most part.	do not confuse him by having him receive instructions from too many people.
Stay as near as maximum safety requires but far enough away to allow enough freedom for the activity.	Do not stand so near that he cannot move or so far away that you cannot possibly be of any assistance.
Have empty hands, so as to be able to support him at a moment's notice.	Do not have pencils, stop watches, records or pocketbooks in hands, since a disabled person falls quickly and there is no time to put down packages.
Touch him as little as possible, as this may be disturbing for one of two reasons: 1. There may be sensitive spastic areas of the body which may respond vigorously and throw him off balance. 2. He will become accustomed to such support, and it will be difficult to break away from it. All hand pressures should be kept to a minimum and be firm and definite and made for a purpose.	Do not have your hands all over him, using uncertain pressures and a fingery touch.
Do not compliment him in the midst of an activity with so much gusto that he becomes excited and loses his equilibrium.	Wait until he has finished the project before complimenting him. In praising achievement, stay strictly within the bounds of truth, so that the subject learns to respect and believe what is said.
Consider him as an injured but not ill person, unless he is truly so. When the injury is in the past, consider the damage done, whatever is left must be developed to make up for what is missing. Every one has some scars somewhere, mental or emotional if not physical; hence an attitude without reference to illness is the proper one to adopt, because it does not set the subject apart.	Do not continually refer to him as an ill person, as this is a discouraging attitude to foster and there is nothing more depressing to a disabled person.

E. Further Unsolved Problems of Crutch-Walkers

The crutch-walker experiences many annoyances as he tries to live as normal a life as possible. One of the most trying is that of having a place to put the crutches. They are often out of reach. They must be kept at hand. Whether or not they are used in a particular activity, such as going upstairs, they must be taken along. They are often in the way. Familiar to all crutch-walkers are the scowls of people in theaters, streetcars and buses who have to scramble over crutches and the outstretched limbs of braced persons. A possible solution is collapsible crutches. However, these are likely not to be practicable, since any collapsing mechanism would be weakening, get out of order easily and be expensive.

Another difficulty with crutches is their instability when not in use. When propped they are continually falling over. Sometimes in the house, where the floor may not be dirty, crutches will remain propped without falling better if they are turned upside down since they have a larger surface as a base.

Another problem of the crutch-walker is that of rainy, stormy and icy weather. This is really a problem for every one; it is all the more perplexing to the disabled person. In addition to having his two feet to slip, he has two crutches. There are such things as ice-creepers which can be placed on the bottom of overshoes. Some modification of these could be placed on the bottom of crutches. Two companies making such devices are the Union Hardware Company, Torrington, Conn., and Widman's Shoe House, Main Street, Canandaigua, N. Y.

F. Recreational and Recreational Therapeutic Activities with Crutches and Canes

Recreation has two aspects: the one, the emotional values obtained from pure recreation, that is, the joy of losing one's self in a pleasurable activity disassociated from working for a living; the other, the therapeutic movement values to the injured part that a particular activity can contribute. Since both aspects of recreation are important, it is merely up to teachers of orthopedic rehabilitation to understand the differences and call on one or the other according to the greater need.

In the following discussion an attempt is made to separate the two aspects of recreation, but since they may and should overlap to some degree a precise dividing line cannot always be maintained.

1. *Recreational Activities.* — It has been somewhat traditional to look upon crutches and canes as handicapping with regard to activities of all sorts. However, many games and sports may be participated in by subjects with crutches and canes. Of course, in games and sports requiring a great deal of running and jumping crutches and canes cannot be used. However, there are many games and sports which do not require running and jumping and which could be adapted fairly easily to the abilities of the disabled participants.

This section is based upon the better development of an unimpaired part of the body, and its main value will be in the purely recreational aspect.

People with crutches have the same urges and desires to participate in recreational activities as normal persons. If the condition which causes them to use crutches occurred early in childhood, they will learn to participate in children's activities. When the disability occurs later in life, then the tendency is to be spectators and use the excuse that they have crutches to avoid participating in activities. From the psychologic and social standpoint, as well as the physical, all disabled people should be encouraged to participate in recreational activities. Too often one finds disabled children excused

from physical education activities and sitting on the side lines looking at their friends enjoying themselves in the gymnasium. It is just as important to teach the crutch-walker social and sports activities best suited to his disability as it is to teach him to travel and care for his daily needs. The cruelty of children is well known, and the mental trauma resulting from being nicknamed "gimpy" or "cripple" and not being able to participate in activities with members of the group is often more difficult to cope with than the physical disability.

The method of selecting the activities best suited for the disabled can be based upon the part of the body involved. There is a one-armed man playing the outfield in baseball, and a pitcher with an artificial lower extremity. There is a paraplegic person who is an excellent swimmer and canoeist, while another young man with a flaccid paralysis of both upper extremities entertains his friends by his skilful tap dancing. Some of the "prevalent defects" for which Stafford[7] lists athletic games, combative sports, dances, individual athletics and stunts, relays, aquatic and miscellaneous sports, are: amputations, ankylosed joints, debilities following long chronic illness or short acute illnesses, debilities due to muscular deficiencies, foot defects, flaccid paralysis, spastic paralysis (cerebral palsy). When both lower extremities are affected, Stafford[8] says, "It is not unusual for these individuals to perform well in crutch hockey, wheelchair relays, swimming, and other similar activities."

2. *Recreational Therapeutic Activities.* — It is common to see some among groups of disabled people at a dance, many of them sitting on seats along the wall, looking longingly at the dancers. Some few people with two crutches have had such good coordination and rhythm that they have been able to do ballroom dancing, making the crutches a rhythmic accompaniment, syncopating the rhythm by tapping the crutches on the floor. However, ballroom dancing is usually awkward with crutches and canes. Other forms of dancing can be used and have been successful. Square dancing has great possibilities with regard to the figures used, and this becomes a good potential medium for the development of special square dances which people on crutches and canes can easily do.

One such square dance is entitled "The Dimpled Dolly Dance."[9] A square is formed, and the dancers perform four simple figures which are either already within their possibilities or else simple enough to be learned. They include "curtsying, bowing, relaxing shoulder girdle and upper extremities, walking short distances in a given time, nodding, standing on tip toes and raising the arms high overhead and waving the hands." The tune of "Turkey in the Straw" is used. The dance is easy to teach and easy to do, and any person who can move in a wheelchair or with canes, crutches, braces or any combination of these may participate. There are no figures which require contact with another person while moving. There is no swinging. There is no handshaking. There is no grasping of partners while in motion. By including simple movements needed by the participants, the dance reinforces physical and occupational therapy and becomes an important adjunct to it.

Some Indian dances are possible for disabled persons. There is a deer dance in which the dancers are costumed as deer. They have elaborate headgear, and, to simulate the four-legged position, they use a short cane in each hand and lean over in their efforts to imitate the animals.[10]

7. Stafford, G. T.: Sports for the Handicapped, New York, Prentice-Hall, Inc., 1939.
8. Stafford,[7] p. 232, footnote.
9. Brown, Mary Eleanor: A Wheelchair, Crutch and Cane Dance for the Orthopedically Exceptional, Occup. Therapy, to be published.
10. Buttree, Julia M.: The Rhythm of the Redman, New York, A. S. Barnes & Company, 1930, p. 52.

There are many other recreational therapy activities which encourage movements. Twenty-five of them have already been used successfully and described:[11] they include modified tumbling, jousting, ball games, bag punching, Indian clubs, Arko top spinning and rope spinning.

Among the activities which are being used currently with severely disabled people just learning to balance on crutches are basket ball games. Detachable peach baskets with bottoms punched out may be hung at different heights on a wall. Each basket has a different score attached to it, the higher on the wall the greater. The players take turns at all the baskets and try for the highest score.

This game may be played by participants (1) seated on a mat Indian style, propped in the back or not as desired; (2) in wheelchairs, propped or not as desired; (3) in ordinary chairs; (4) standing in parallel bars; (5) standing on crutches.

Another group basket ball game is played by two teams, composed of from three to five players each, each team standing in a separate set of parallel bars which face one another sideways and are about 6 feet apart. A referee keeps score and tosses the initial ball. The players throw the ball from team to team. When the ball falls on the floor, the team who threw it gains a point. Throwing the ball above the heads of the players and below the top bar of the parallel bars constitute fouls and are penalized.

Throwing quoits is another game easily adjusted to floor, chairs, wheelchairs, parallel bars and crutches. Bag punching, shuffleboard, table tennis and billiards are still other games which can be easily adapted to most disabilities, even the severest. Bags can be lowered to suit floor or chair, or platforms may be used if more convenient.

"Follow the leader" and "musical chairs" are two group games which have recreational and therapeutic values, since daily activities, movements, exercises and stunts may be incorporated in them.[11]

The field of recreational therapeutic activities and adaptive sports is one teeming with possibilities. All that is required is an alertness to the movement possibilities and needs of the individual and an intuitive sense for selecting or devising an appealing competitive game.

In the history of acrobats and acrobatics one would undoubtedly find numerous performers who have had an orthopedic disability. Of all the acrobatic acts on vaudeville bills, cannot we all recall at least one acrobat who had a thin spindly leg and a flopping foot—recognizable now as an obvious poliomyelitis victim. Certainly a person interested in games and sports, dancing, stunts and acrobatics should not be prevented from pursuing them even if this is in an adapted or limited form. People with crutches and canes can learn numerous stunts which can be devised according to their abilities. In fact, in 1938 there was an athletic school for cripples only at Hohenlychen, near Berlin.[12]

Setting-up exercises are literally the life of the community in Hohenlychen, the government sanatorium at which these unusual pictures were taken. The patients are cripples who are "set up in life" by means of strenuous athletic routines, on the interesting theory that one who has learned to overcome his physical handicaps will be a more useful and happy citizen in his daily life. It is when a man with an incomplete anatomy starts to be defensive about his condition, and feels helpless, that his mental health starts to suffer.

To avoid this, exercise is the constant rule at the hospital fifty miles from Berlin. The men are taught to be adept at all kinds of sports. A missing leg or arm is no excuse for shirking workouts on the trapeze, on the "horses," or on the exercise wheel. Neither is it accepted as an alibi for declining to run, jump, and box with fellow-

11. Brown, Mary Eleanor: Recreational Therapy for the Orthopedically Exceptional, Occup. Therapy, 24:171-178 (Aug.) 1945.
12. 1938 newspaper clippings from the files of the Institute for the Crippled and Disabled.

cripples. Graduates come out smiling and self-reliant, and have nothing but praise for their "alma mater." . . .

There are photographs (1) of a young man just completing a high jump in spite of an almost complete amputation of the right upper extremity; (2) of a man with only about 2 inches left of his left upper extremity inside a man-size exercise wheel; (3) and two men with above the knee amputations "fighting it out with gloves," and balancing "even after heavy punches."

There are other newspaper photographs, clippings and magazine articles bearing witness to the marvelous feats of many superior disabled people. There is one of Yves Gosselin, a brilliant Canadian skier with a high above the knee amputation, executing a fast "Christie" turn.[13] There is also Bert Porter, a young American skier, who uses an artificial limb for skiing. Then there are the no less than astounding achievements of the wearers of Desoutter artificial limbs.[14]

Dancing, cycling, jumping, driving foot-driven motor cars, playing golf, boarding a moving bus, jumping off a moving bus, horseback riding—including mounting and taking jumps—tennis, motorcycling, boxing and skiing are all represented photographically.

The Desoutter brothers describe in the back of their book the crowning achievements which are the records made by wearers of Desoutter equipment in the authoritative walking races for limbless men organized by the "Star" newspaper since 1922; flying a plane; and mountain-climbing. A photograph, entitled, "Climbing Snowdon on a Desoutter," has as its caption: "Mr. Charles Shelton, wearing a Tilting Table Desoutter Light Limb, going over the boulders during his ascent of Snowdon (a climb of 3,571 feet), which he accomplished in the remarkable time of under three hours: his amputation is through the hip-joint."

In this country, J. E. Hanger, Inc. "makes a thousand artificial limbs a month, and has organized a baseball team of customers all of whom have lost either arms or legs and yet play regular benefit games around New York. This year the schedule was cut somewhat because so many members are employed in defense industries they have no time to practice. . . . Joe Spivak, one time president of the association, lost both legs at 17 as a brakeman on the Erie R. R. At 50 he is so agile he can kick a football."[15]

Stephen J. Zablotney,[16] sportsman extraordinary, perfected an act in roller skating and enjoys swimming, diving, life saving, tennis, basket ball, fencing, baseball and dancing, as well as ice skating, which he can do with and without a crutch.

A one-legged athlete covers 1,500 mile walk are the headlines to this newspaper squib:

> When Sebastian Scheidl, one-legged Bavarian athlete, reached Kiel to-day, he had completed fifteen hundred miles of the three thousand-mile walk which he believes will set a record that will hold all other one-legged aspirants for some time. Scheidl was a noted walker before the war, in which he lost a leg, but he believes he is now able to equal his former records with one leg and a crutch.[17]

G. Vocations for Crutch-Walkers

Independence and security are natural desires of almost every one. These objectives can be obtained only through work which is salable. The selection of vocations for the so-called normal is based upon the interests, satisfactions and needs of the person, and there are thousands of vocations

13. New York *Times*, Jan. 28, 1940.
14. Progress and Achievement, London, DeSoutter Bros., Ltd., 1933.
15. McEvoy, J. P.: You Can Walk Without Legs, Hygeia, 21:564 (Aug.) 1943.
16. Happy Smiles, September, 1945, p. 3.
17. Special wireless dispatch to the *Sun*, from the Sun Bureau, Berlin, Sept. 8, 1925.

from which to choose. In selecting a vocation for a disabled person, however, his physical capacity must receive first consideration, and his interests, satisfactions and needs have second place. The evaluation of the physical capacity of the disabled person is the function of the physician and therapist. The choice of a vocation is the role of the vocational counselor.

All education is directed toward developing the hidden potentialities of all of us and to fitting us for suitable work in life. Surely, when we have disabilities, selective placement, or the matching of capacities to job demands, is all the more important. "Most disabled persons have far more ability than disability. When such workers are placed according to their abilities, in jobs making no physical demands they cannot meet, the disability will disappear as a job handicap." [18]

The War Manpower Commission, Bureau of Manpower Utilization, has issued a physical demands form for matching workers to jobs.[19] This form contains twenty-seven physical activities used in jobs, such as walking, jumping, climbing and pushing. A physical demands and capacities analysis has been made for approximately five hundred shipyard jobs.[19b]

This analysis provides methods for conducting similar investigations of other industries. The United States Civil Service Commission has analyzed 5,100 of their jobs.[20]

Therefore, it is becoming more and more possible to evaluate the physical capacity of the crutch-walker to perform job activities, so that he may have a profile of his ability to meet the needs of the vocation in which he is interested. With such a profile the person can select a vocation and see whether he has the physical capacity to meet the needs of the job.

It is impossible to evaluate the ability of a person to perform an activity unless he is tested in that activity. Some severely disabled persons use crutches as if they were part of themselves and perform activities which a much less severely disabled person or many a so-called normal person cannot achieve. A man with two artificial limbs above the knee may be able to climb a ladder, while another with one artificial limb below the knee cannot perform this activity.

Thus the greatest and most fundamental need in the rehabilitation of disabled persons is the evaluation by objective testing of their physical capacity to perform the activities essential for daily life [21] and work.[22]

It is the right of every disabled person to have an inventory of his abilities and disabilities. To help the disabled person make the most of himself is the goal of rehabilitation.[23]

A New Vocation for the Disabled. — Living and working with crutches and canes is a subject which only the disabled people themselves can know about at first hand. Disabled people do not listen attentively to normal people expounding theories; they do pay attention to a disabled man who has accomplished daily activities and become independent.

To our knowledge there is only one severely disabled man who is employed in a hospital for the purpose of instructing other disabled people. Even this one man, while a well informed and highly intelligent person, is

18. Bridges, C. D.: Job Placement of the Physically Handicapped, New York, McGraw-Hill Book Company, Inc., 1946, p. 27.

19. (*a*) Bridges,[18] p. 271. (*b*) United States War Manpower Commission. Physical Demands and Capacities Analysis: Part I. Physical Demands and Capacities Analysis; Part II. Physical Demands Information, Shipbuilding Industry, San Francisco, War Manpower Commission, and Oakland and Richmond, Calif., Permanente Foundation Hospitals, May, 1944.

20. Harvey, V. K., and Luongo, E. P.: Physical Capacity for Work, Occup. Med. 1:1-47 (Jan.) 1946, p. 26.

21. Footnotes 1 and 2.

22. Deaver, George G., and others: Physical Demands of Daily Occupations: A Scale for Rating the Orthopedically Exceptional, to be published.

23. A list of the publications on rehabilitation of the Medical and Physical Rehabilitation Service of the Institute for the Crippled and Disabled, with prices, is obtainable from the library, Institute for the Crippled and Disabled, 400 First Avenue, New York 10, N. Y.

not trained in the elements of anatomy and physiology; nor has he studied posture and body mechanics.

We are proposing that a course be organized for disabled people of proper qualifications and achievements to acquaint them with the fundamentals of orthopedic rehabilitation, so that they can be employed in the hospitals to act as rehabilitation aides to instructors of orthopedic rehabilitation.

H. The "Bonfire" of Crutches

On clinic benches in crowded waiting rooms the world over, men, women and children of all ages sit crookedly, encased in braces and burdened down with crutches and canes and other appliances. It often occurs that they leave the clinics with the same appliances, despite earnest and careful consultations. It is urged that orthopedic clinics be discriminating with regard to appliances, since their patients are apt to take for granted that they are to wear them forever, although their condition may have improved and they no longer really need them.

Many are the stories of people who have been wearing braces for ten years or more, never having had any really acute trouble. These people have just taken it for granted that they should wear the same braces or use the same crutches or canes just as long as they last. One young woman of 25 limped down the hall on an old brace which a doctor had recommended for her nine years previously. Her reason for asking medical advice at this particular time was for a skin condition on the extremity which was not braced. Not only did the doctor treat the skin condition, but the patient left without any braces at all. The doctor had a muscle test given and discovered that the brace was much more of a hindrance than otherwise, and it was immediately cast off. These instances multiply with experience with orthopedically disabled persons.

It is often taken for granted that when appliances are needed the subject is simply going to remain in a static condition and always require these same appliances. This is, of course, entirely untrue, since no one remains in such a static condition. In fact, in the case of any subject with braces and/or crutches there is always the possibility—no matter how slight—of improving to the point where braces or crutches are not needed, and encouragement to work toward that goal should always be offered. However, if it seems as if the subject is never going to be able to do without his braces or crutches, he nevertheless should be given the idea that if he does exercises here is a chance for him to improve to a point where perhaps a less burdensome or less complex combination of appliances may suffice for his condition.

It is important for people who wear braces or use crutches to be cautioned not to wear them all the time. There should be periods during which they do not wear braces or use crutches, and during that time they need exercises without the appliances.

In a school or clinic or among groups of disabled people there should be a yearly figurative bonfire of crutches and canes and braces, making this so much of a ritual that the people realize that as they progress they should make every effort to discard some if not all of their appliances.[24]

---

24. The newly formed Mutual Aid Association for the Disabled, with present headquarters at the Institute for the Crippled and Disabled, has as one of its major projects an appliance cooperative, which will make appliances available to members at minimum prices. To initiate this venture, members are pooling all old equipment to be sold or rented as second-hand materials to members who need it. Some may also be sold or rented to teaching institutions for display purposes.

Fig. 2. — The bonfire of crutches: detail from Beham's "Fountain of Youth" (*ca.* 1570). Reproduced through the kindness of Sigmund Epstein, M.D., New York.

Conclusion

To some people crutches are their most needed friends. Recently a hardy little man of 81—a veteran of two wars—angrily remonstrated because he had to wait for crutches and an artificial limb. "Every week counts" he said with spirit. May the information in these articles lead others to feel the same way toward their aids to independence.

APPENDIX I

The following exercises supplement those already given.[25] They include bed or mat exercises, parallel bar exercises and crutch exercises. They are

25. Deaver, George G., and Brown, Mary Eleanor: The Challenge of Crutches. II. Crutch-Walking: Muscular Demands and Preparation, Arch. Phys. Med. 26:515-525 (Aug.) 1945.

numbered to follow the earlier exercises. By incorporating them into an exercise file as suggested heretofore,[26] one may keep them at hand for quick reference. As the needs of rehabilitation grow and procedures develop, the scope of the exercises may expand. The idea is in mind for the future to collect exercises which definitely lead to specific daily activities. For instance, if a disabled person cannot get from one part of the bed to another, he should be handed a "procedure sheet" containing the exercises leading up to the achievement of this particular daily activity. Bed or mat exercises 8 and 9 would be on such a procedure sheet. Through the card file system, the exercises can be shuffled, reclassified and renumbered in any desired order. New exercises can be added easily.

A. Additional Bed or Mat Exercises

The Bed or Mat Exercises include abdominal, flexibility and balancing activities.

Bed or Mat Exercise No. 6. — Abdominal Exercise for Vertical and Oblique Muscles.

Purpose: To strengthen the vertical and oblique abdominal muscles.

Equipment: Bed or mat.

Position: Supine, lower extremities extended, palms together in center line of body.

Instructions: Raise head and shoulders from floor (without sitting up), reaching forward with hands as far as possible on a count of five and return on a count of five. Repeat, pointing hands diagonally out to right side, then center again, then left side, then center, etc. *Do fourteen times in all.*

Bed or Mat Exercise No. 7. — Abdominal Exercise for Lateral Muscles.

Purpose: To strengthen the lateral abdominal muscles.

Equipment: Bed or mat.

Position: Side-lying, underneath knee bent for balance, underneath upper extremity bent so that head may be supported on it, top upper extremity stretched along top side of body.

Instructions: Tighten the muscles along the top side of body raising head and shoulders as much as possible off floor and reaching downward with hand, while maintaining good side-lying alinement. Slowly return to floor. *Repeat ten times.* Perform on other side.

Bed or Mat Exercise No. 8. — Flexibility for Rolling.

Purpose: To develop power and speed to roll over.

Equipment: Bed or mat.

Position: Supine, upper and lower extremities extended.

Instructions: Make a quarter roll to the right so as to be on the right side. Make another quarter roll so as to be on the face. Make a quarter roll so as to be on the left side, then a quarter roll so as to be on back. *Continue full length of mat and back.* (Position of upper extremities may be varied as desired.)

Bed or Mat Exercises No. 9. — Flexibility for Moving Sideward Without Rolling.

Purpose: To develop power and speed to move without rolling.

Equipment: Bed or mat.

Position: Supine, upper and lower extremities extended.

Instructions: Raise head and shoulders, move to right and place them on the mat. Raise pelvis, move to right and place on mat in line with head and shoulders. Adjust lower extremities so that they are in line with rest of body. Sequence: head and shoulders, pelvis, feet. *Repeat ten times.* Perform same exercise to left. *Repeat ten times.*

Bed or Mat Exercise No. 10. — Flexibility for Touching Toes with Feet Together.

Purpose: To develop flexibility in whole body.

Equipment: Bed or mat.

Position: Supine, upper and lower extremities extended at sides.

Instructions: Come to a sitting position in any way possible, then lean over and touch toes, knees remaining straight, bouncing forward five times and then lying down again. *Repeat five times.*

Bed or Mat Exercise No. 11. — Flexibility for Touching Toes with Feet Apart.

Purpose: To develop flexibility of trunk and hip joints.

Equipment: Bed or mat.

Position: Sitting, upper extremities outstretched, trunk erect, lower extremities extended and spread apart as much as possible.

Instructions: Bend forward at hip joints and touch one foot with both hands; return to sitting position; then bend forward, reaching toward center between feet; return to sitting

26. Deaver, and Brown,[25] p. 519.

position and bend forward, touching other toe. Sequence: right, center, left, center, etc. *Repeat sequence six times.*

Bed or Mat Exercise No. 12. — Flexibility for Back-Arching.

Purpose: To strengthen back muscles, stretch chest muscles and develop flexibility of back and shoulder girdle region.

Equipment: Bed or mat.

Position: Prone, hands clasped behind back.

Instructions: Raise head and shoulders as high as possible, lifting hands off back. Lower slowly. *Repeat ten times.*

Bed or Mat Exercise No. 13. — Balancing in a Sitting Position.

Purpose: To develop sitting balance.

Equipment: Bed or mat.

Position: Sitting, lower extremities extended, hands on mat at sides supporting body, fingers extended but closed and pointing forward.

Instructions: Raise both upper extremities forward as far as balance can be maintained. Lower. Raise to side. Lower. Raise backward. Lower. (This may be done singly if it cannot be done together.) Sequence: forward to shoulder height, sideward, backward, sideward. *Repeat five times.*

Bed or Mat Exercise No. 14. — Balancing While Rolling.

Purpose: To learn to control lower extremities and keep balance while rolling to either side.

Equipment: Bed or mat.

Position: Supine, knees bent and hugged to chest with hands around them.

Instructions: Roll from side to side keeping the knees controlled and rolling precisely. Sequence: right, middle, left, middle, etc. *Repeat five times to each side.*

Bed or Mat Exercise No. 15. — Balancing on Hands and Knees.

Purpose: To develop crutch-walking and abdominal muscles, ability to balance on hands and knees, and flexibility of the back.

Equipment: Bed or mat.

Position: Hands and knees: shoulder joints over elbow joints over wrist joints; hip joints over knee joints.

Instructions: Round the back, hang the head, draw in the abdominal wall strongly while exhaling. Arch the back, raise the head and pelvis, allowing the back to hang in and the abdominal wall to relax completely. *Repeat ten times slowly without jerking.* Finish with level back.

B. Parallel Bar Exercises

The parallel bar exercises include flexibility, balancing and crutch-walking muscle strengthening activities.

Parallel Bar Exercise No. 1. — Flexibility for Pelvis.

Purpose: To limber up stiff hip and lumbar intervertebral joints and learn to control the pelvis.

Equipment: Parallel bars or substitute support for the upper extremities.

Position: Standing holding onto bars.

Instructions: Maintaining the trunk as upright as possible move the pelvis forward, then backward. *Repeat ten times in each direction.* Move the pelvis sideward in either direction. *Repeat ten times in each direction.* Circle the pelvis as follows: front, right, back, left. *Repeat ten times.* Reverse direction of circle. *Repeat ten times.*

Parallel Bar Exercise No. 2. — Flexibility for Pelvic Position.

Purpose: To learn to get pelvis ahead of rest of body.

Equipment: Parallel bars.

Position: Standing facing one bar and holding on with both hands with elbows stiff, feet on floor against other side of bars.

Instructions: Lean forward allowing elbows to bend until pelvis is as near as possible to the bar in front and return to original position. *Repeat ten times.*

Parallel Bar Exercise No. 3. — Flexibility for Shoulder Girdle and Neck.

Purpose: To strengthen, relax and induce circulation in the shoulder girdle and neck muscles.

Equipment: Parallel bars or substitute support.

Position: Standing holding onto bars, or in wheelchair.

Instructions: Raise shoulder tips forward and upward to ears on count of 1; draw shoulder blades together tightly, keeping head straight, on the count of 2, and lower shoulders, keeping blades together, on the count of 3, relax on the count of 4. *Repeat ten times.* Reverse order. *Repeat ten times.*

Parallel Bar Exercise No. 4. — Flexibility for Shoulder Girdle and Upper Extremities.

Purpose: To induce relaxation and circulation in upper extremity and shoulder girdle muscles while maintaining balance.

Equipment: Parallel bars.

Position: Standing holding onto bars.

Instructions: Holding on with one hand, attain balance and lift other extended upper extremity to side. Start a tiny circumductory motion by moving first forward and then down, back and up. Keep enlarging circle. *Repeat ten times.* Repeat on other side. *Repeat in reverse ten times on each side.*

Parallel Bar Exercise No. 5. — Balancing While Clapping.

Purpose: To develop balance.

Equipment: Parallel bars.

Position: Standing holding onto bars.

Instructions: Quickly clap hands in front of body, behind body, overhead, replacing hands on bars between claps. *Repeat ten times.*

Parallel Bar Exercise No. 6. — Balancing While Turning.

Purpose: To learn to control body, develop kinesthetic sense and change position.

Equipment: Parallel bars.

Position: Standing holding onto bars.

Instructions: Take right hand off right bar; raise it overhead, upper extremity extended, and place it across front of body onto other bar, a body's width from other hand. Maneuver body so as to face hands, and turn feet. Place left hand on other bar and turn body and feet so that a half turn has been made. Make two more quarter turns until original position is resumed. *Repeat, precisely, four times.* Reverse. *Repeat four times.*

Parallel Bar Exercise No. 7. — Balancing with One Hand Off.

Purpose: To learn to balance with one hand.

Equipment: Parallel bars.

Position: Standing holding onto bars.

Instructions: Face partner; take right hand off and shake hands. Replace hand. Take left hand off and shake hands. *Repeat to a count of twelve.*

Parallel Bar Exercise No. 8. — Balancing Without Holding On.

Purpose: To develop balance ability and learn to balance without holding on.

Equipment: Parallel bars and metronome.

Position: Standing holding onto bars.

Instructions: Assume the best body alinement possible; then remove both hands and record how long, by metronome, this position can be held.

Parallel Bar Exercise No. 9. — Strengthening Crutch-Walking Muscles.

Purpose: To strengthen all the crutch-walking muscles and develop control of body.

Equipment: Parallel bars.

Position: Weight on hands, upper extremities extended, body off floor.

Instructions: Facing forward, move body from one side to other so that pelvis touches bar each time. *Repeat five times to either side.* Rest. Repeat and add a twist so that whole body turns to hand of side which touches bar. *Repeat five times to either side.*

C. Additional Crutch Exercises

The crutch exercises comprise suggested routines for developing certainty of balance in the management of crutches.

Crutch Exercise No. 3. — Lifting Crutches Alternately.

Purpose: To develop balance and agility in handling crutches.

Equipment: Properly adjusted crutches.

Position: Standing against or away from a wall, as desired.

Instructions: Alternately lift one crutch forward, then the other, with upper extremity fully extended to shoulder height, so that the crutch base points straight forward. *Repeat ten times to each side.* Perform same exercise to each side, to the back and overhead by going both forward and upward and sideward and upward.

Crutch Exercise No. 4. — Lifting Crutches Simultaneously and Twisting Trunk.

Purpose: To develop balance and agility in handling crutches.

Equipment: Properly adjusted crutches.

Position: Standing against or away from a wall, as desired.

Instructions: Lift body crutches and place them as far to one side of body as possible without changing foot position or losing balance. Perform to other side. *Repeat five times to each side.*

Crutch Exercise No. 5. — Managing Crutches While Bending Trunk Forward.

Purpose: To develop balance and agility in handling crutches.

Equipment: Properly adjusted crutches.

Position: Standing against or away from a wall, as desired.

Instructions: Bend trunk sharply forward and downward, adjusting crutches according to needs. This may be done by taking crutches out from under arms, grasping the hand pieces and using them as canes. Resume standing position. *Repeat three times.*

Crutch Exercise No. 6. — Managing Crutches While Touching Floor.

Purpose: To develop balance and agility in handling crutches.

Equipment: Properly adjusted crutches.

Position: Standing against or away from a wall, as desired.

Instructions: Bend over and touch the floor first with one hand and then with the other, adjusting crutches accordingly. They may be taken out from under the arms, the hand-pieces grasped and used as canes. Return to upright position. *Repeat three times.*

Crutch Exercise No. 7. — Clapping with Crutches.

Purpose: To develop balance and agility in handling crutches.

Equipment: Properly adjusted crutches.

Position: Standing against or away from a wall, as desired.

Instructions: Raise both crutches and quickly clap them together and replace on floor. *Repeat five times.*

Many more exercises, drills and routines should be devised, based upon needs of individual crutch-walkers. A principle to be followed is to discover the weaknesses of the subject and develop the exercises around them. For instance, if a particular disabled person who is learning to do a swinging-through gait tends to swing through unevenly, allowing his body to move too much to one side, invent an exercise whereby he must do this deliberately, first to the side toward which he makes the error, then toward the other side, and then in the middle. Repeat the exercise over and over again. The awareness gained through such experience justifies the time spent.

APPENDIX II

Addition

As a result of concentrated work with severely disabled subjects with paraplegia from spinal cord injury, a new disability evolves to be added to table 2, *Prescription of Crutch Gaits for Orthopedic Disabilities* (ARCH. PHYS. MED. 26:751 [Dec.] 1945), as Disability VII. The analysis follows:

DISABILITY VII

Crutch Gait Determinations 3, 6, 8, 10.—

(3) Steps cannot be taken forward with either lower extremity.

(6) Weight-bearing and balance can be maintained on both lower extremities, only with crutches.

(8) Body can be lifted to clear the floor.

(10) Body cannot be maintained erect. (Determinant 10 on the original chart should be changed by deleting the last seven words, so that it will read: "Body cannot be maintained erect.")

Prescription. — Tripod alternate.

People who need to wear knee-locked braces and use crutches and who also have contracted anterior hip joint muscles and therefore must bend forward at the hips, cannot do the swinging-to or swinging-through gaits, nor can they even accomplish the tripod simultaneous gait. The reason for this is that the pelvis cannot be brought forward and consequently there is not enough stability to permit the two crutches to be raised at one time, since in so doing the body is thrown too far backward and there is danger of falling over backward. The only safe gait is the alternate tripod. Nevertheless, as the contractures are reduced by crutch preparation, daily activity practice, manual and pulley stretching, the harder gaits may be attempted (Deaver, George G., and Peterson, Kjell J.: Pulley Exercises to Increase Joint Movement, ARCH. PHYS. MED. 27:17 [Jan.] 1946).

This is the concluding article of the series. The previous articles have appeared in THE ARCHIVES for July 1945, August 1945, September 1945, December 1945 and March 1946.

MEDICAL NEWS

New York Society of Physical Medicine

The regular monthly meeting for November of the New York Society of Physical Medicine will be held Wednesday evening, November 6 at 8:30 p.m., Einhorn Auditorium, Lenox Hill Hospital, New York City. Dr. Bernard Stoll will present "The Results of Electrical Stimulation of Denervated Muscle" and Dr. Sidney Licht will give "Objectives of Occupational Therapy." Participating in the discussion will be Lt. Col. Charles R. Brooke, Dr. Lester Breidenbach and Miss Jane E. Myers, O. T. R.

Two papers were read at the October meeting: "Results of Paravertebral Block and Sympathectomy in Peripheral Vascular Disease" by Dr. J. Byer, and "Cold Injuries of the Limbs and Their Treatment" by Dr. I. D. Stein.

"Real Life" Demonstration at American Legion Convention

Thousands of Legionnaires saw for the first time the vast strides which were made in World War II in the fields of rehabilitation, physical medicine, convalescent care and reconditioning in the presentation of a "real life" demonstration. This was arranged by the American Legion National Rehabilitation Committee and was presented by T. O. Krabel, director; Charles McGonegal, nationally known amputee of World War II; Dr. Donald Covalt, director of the Medical Rehabilitation Program of the Veterans Administration and Dr. Howard A. Rusk, Associate Editor, New York *Times**.

Course of Instruction for Physical Therapists at Hines

"Physical Therapy Procedures in Thoracic Surgery" was the topic covered in a course of instruction for physical therapists held October 1 to 14 at the Veterans Administration Hospital, Hines, Illinois. That the subject was well presented is evidenced by noting the following who were in charge of the various lectures and demonstrations: Mildred Andrews, Physical Therapist, Veterans Administration Hospital, Hines, Ill.; Viola Bryson, Field Supervisor in Physical Therapy, Central Office, Washington, D. C.; Dr. K. A. Carroll, Manager, Veterans Administration Hospital, Hines, Ill.; Mary Courtney, Physical Therapist, Veterans Administration Hospital, Hines, Ill.; Frances Doyle, Physical Therapist, Veterans Administration Hospital, Hines, Ill.; Dr. Jerome Head, Senior Consultant, Thoracic Surgery; Dr. O. Leonard Huddleston Sr., Consultant in Physical Medicine, Branch Office No. 12; Florence S. Linduff, Field Supervisor in Physical Therapy, Central Office, Washington, D. C.; Esta McNett, Nurse Specialist in Tuberculosis, Central Office, Washington, D. C.; Dr. Richard H. Meade, Consultant, Thoracic Surgery; Dr. Holland C. Mitchell, Ass't Chief, Phys. Medicine Serv., Veterans Adm. Hospital, Hines, Ill.; Dr. Louis C. Morris, Consultant, Tuberculosis Service; Dr. Louis B. Newman, Physician-in-charge, Medical Rehabilitation; Chief, Physical Medicine; Dr. Arnold Shamaskin, Chief, Tuberculosis Service; Nora Staael, Director of Physical Therapy, University of Illinois, School of Medicine; Dr. Henry C. Sweany, Senior Consultant, Tuberculosis Service and Dr. N. C. Trauba, Clinical Director, Veterans Administration Hospital, Hines, Ill.

Dr. K. A. Carroll is the manager of this hospital.

* Rusk, New York *Times*. Sept. 29, 1946.

Physical Medicine at Percy Jones

Weekly programs of professional activities have been inaugurated at Percy Jones General Hospital, Battle Creek, Michigan, to which all physicians are invited. Col. A. E. White, Chief of Service, Physical Medicine presides each Monday at a conference of Staff, Physical Medicine. On October 21, Col. White discussed "Introduction to Physical Medicine" at the conference of the Hospital Staff.

Careers for Medical Officers in Physical Medicine

The opportunity to specialize in physical medicine offers to medical officers prospects for a very gratifying career. The purely medical aspects of physical therapy, occupational therapy and physical reconditioning are being stabilized as a physical medicine service. The nonmedical aspects of reconditioning will be administered under a proposed convalescent services division. In general hospitals, the physical medicine service will be a major service on a level with the medical service and the surgical service.

Physical medicine is now a recognized specialty. Information has been received from authoritative sources that an American Board of Physical Medicine is to be established in the near future. In order to qualify medical officers in this field, there is being established a professional training course of six months' duration in a large metropolitan medical center. After completing this course, individuals will be assigned to physical medicine services in general hospitals for applicatory, on-the-job training, leading to completion of the requirements for board certification.

If the size of the standing Army is placed at 850,000, as recommended by General Eisenhower, there will be a need for about 59 medical officers who are qualified as specialists in physical medicine. At the present time, only a very small number of medical officers are so qualified. In

(Continued on page 706)

ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

CLINICAL RESEARCH IN PHYSICAL MEDICINE

Studies on circulation are of particular interest to the physiatrist as so many of the known effects of physical agents are derived through circulatory mechanisms. The investigations of Martin and his co-workers reported in this issue, on vasomotor adaptability in patients with rheumatoid arthritis are of double importance as physical therapy is considered indispensable in the regimen of treatment of this condition and the rationale of its use is elucidated in respect to circulation. Many authors have reported on the sluggish state of the peripheral circulation of patients with this disease and almost instinctively they avoid exposure to cold when possible. The occurrence clinically of vasospastic abnormalities including Raynaud's syndrome has been frequently cited in this group of patients. The studies of Martin et al. indicate, however, that there is not a constant defect in vasomotor adaptability. Objective evidence of cold intolerance is provided for they found that vasoconstriction is sluggish and incomplete upon exposure to cool environments. The rationale for the use of heat is thus apparent. Other methods of producing vasodilatation may similarly be indicated. A recent preliminary report by Kurtz and Orth[1] suggests that large and frequently repeated dosage of nicotinic acid to produce a flushing reaction is beneficial along with physical therapy in the treatment of patients with rheumatoid arthritis.

The second and third papers of Martin and associates are likewise noteworthy for by such careful clinical research, empiricism can be eliminated from the prescription of physical medicine. Dry or moist heat was found to be equally effective in raising cutaneous temperatures and the simple procedure of a hot tub bath produced vasodilatation in the hands and feet of even longer duration than local applications of heat. Massage, as might be anticipated, also increased the temperature of the extremities treated to a lesser and varying degree. Other clinical investigations of this sort concerning the effect of short wave diathermy would be of interest. The use of diathermy on joints with effusions is commonly thought to be contraindicated. This point has been studied in a small series of patients[2] by noting the effect of daily treatments upon the character of the joint fluid. In no instance was an adverse reaction found in regard to cell count, sugar level or mucin content. All patients noted subjective improvement which was also verified by some slight increase in range of joint motion. The size of the effusions was not, however, significantly altered.

There are many other similar opportunities for interesting and valuable clinical research in Physical Medicine. With the rapidly increasing number of physiatrists we should look forward to many fundamental contributions to medical knowledge of this type.

---

1. Kurtz, C. M., and Orth, O. S.: The Treatment of Rheumatoid Arthritis Via Vasodilatation, Interne, pp. 607-612, September, 1946.
2. Watkins, A. L.: Unpublished data.

Medical News

(*Continued from page 704*)

order to build up a group of competent, well qualified medical officers for professional assignments in physical medicine, the Army offers an unusual opportunity to enter a career in this specialty.

The Surgeon General has personally pointed out that officers who have recently begun specialty training, or who have not chosen their medical specialty, should carefully consider the broad field of physical medicine as a professional career with a bright future. For medical officers of the Regular Army who have been on extended assignments of an administrative nature but who now desire to obtain training in a promising specialty, physical medicine warrants major consideration. For other medical officers (Army of the United States, Officers' Reserve Corps and National Guard) who anticipate remaining on active duty for an indefinite period, the same holds true.

For further details interested medical officers should communicate directly with the Director, Physical Medicine Consultants Division, Office of The Surgeon General, War Department, Washington 25, D. C.

National Foundation for Infantile Paralysis

Increased enrollment of students in the physical therapy training course of the University of California Medical School has been made possible by a recent grant of $6,336 from the National Foundation for Infantile Paralysis. Among the teaching essentials aided, the new grant will provide 236 semester hours in anatomy, physics, pathology, physiology, nursing, pediatrics, and neurology. The courses, given under the direction of Doctor Frances Baker, include specialized treatment of infantile paralysis patients.

To date, the National Foundation has provided the University of California Medical School with $14,336 to aid in the training of physical therapists at that institution.

Under the direction of a medical committee on the treatment and after-effects of poliomyelitis a muscle chart has been prepared. This chart is a standard type of record of muscle strengths especially desirable for use in the care of poliomyelitis patients, and can be used advantageously by the physical therapy departments of hospitals and clinics.

The Medical Advisory Committee of the National Foundation is desirous of making these charts more widely available to professional personnel and institutions caring for poliomyelitis patients. These muscle charts, which offer a standard record of muscle strengths, are available free of charge and in quantity from the National Foundation for Infantile Paralysis, 120 Broadway, New York 5, N. Y.

College News

University of Texas Medical Branch. — W. A. Selle, professor of physiology, is surveying American medical centers under the auspices of the Baruch Committee for Physical Medicine in order to develop satisfactory methods for teaching the medical application of physics to undergraduate medical students.

Loyola University School of Medicine. — Dr. James J. Smith, formerly of the Northwestern University Medical School faculty, has been appointed dean to succeed Dr. Italo Volini, who resigned some time ago. He has just been released by the Army after five years' service in the field of physiology. A graduate of St. Louis University Medical School, Dr. Smith took graduate work at Northwestern University, where he received an M.S. degree in pathology and a Ph.D. degree in physiology. Dr. Smith served for a year as an assistant in pathology at Cook County Hospital. He was an assistant instructor in the department of clinical pathology at the University of Illinois College of Medicine and also did research and teaching at Northwestern Medical School before entering the Army in 1941.

Southwestern Medical College. — Brig. Gen. William Lee Hart, U. S. Army Medical Corps, retired, has been appointed dean to succeed Dr. Tinsley Harrison, who wishes to devote all his time to research and teaching. Dr. Donald Slaughter, dean of students, has accepted the deanship of the University of South Dakota School of Medicine, which is to be expanded into a four year school. Until Dr. Hart takes up his duties as dean, Dr. William F. Mengert, professor and head of the department of obstetrics and gynecology, will act as dean.

Medical Research Center

An Army Medical Research Center at Forest Glen, Md., has been proposed by Surgeon General Norman T. Kirk. It is the site of the convalescent annex attached to Walter Reed General Hospital during the war and will take approximately twelve years to construct.

New Deputy Surgeon General

Dr. James A. Crabtree, medical director, U. S. Public Health Service, was appointed Deputy Surgeon General of the Public Health Service, effective September 1. Since September, 1945 Dr. Crabtree has served as special assistant to the Surgeon General. In his new assignment he will be second in command of the Public Health Service. The rank of Deputy Surgeon General is equivalent to that of a Commodore in the Navy or a Brigadier General in the Army.

Medical Department Board Reestablished

An important step in the postwar program of the Army Medical Department has been taken in the establishment of the Medical Department Board at Brooke Army Medical Center, Fort Sam Houston, Texas. The board was previously located at Carlisle Barracks, Pa., and was dis-

continued during the war, its activities being largely delegated to the field.

The board will study changes that will be required in army medicine to keep abreast of concepts of modern war and will inform the Surgeon General's Office of new technics and act on all matters referred to it by the Surgeon General. The board will consider the organization and equipment of medical units, tactical employment of Medical Department troops and changes and improvements in Medical Department equipment.

The chairman of the board is Brig. Gen. John M. Willis, surgeon of the Middle Pacific area during the war and now commanding officer of the Brooke Army Medical Center.

Hospitals Approved for Residency Training in Physical Medicine

[1]Los Angeles County Hospital, Los Angeles.
[1]Massachusetts General Hospital, Boston.
Mayo Foundation, Rochester, Minnesota.
Michael Reese Hospital, Chicago.
[1]Montefiore Hospital for Chronic Diseases, New York City.
[1]Mount Sinai Hospital New York City.
Passavant Memorial Hospital, Chicago.
[1]Presbyterian Hospital, New York City.
St. Luke's Hospital, New York City.
Stanford University Hospitals, San Francisco.
[1]State of Wisconsin General Hospital, Madison, Wisconsin.
[1]University of California Hospital, San Francisco.
[1]University Hospitals, Minneapolis, Minnesota.
Walter Reed General Hospital, Washington, D. C.
University of Kansas Hospital, Kansas City, Kansas.
[1]Goldwater Memorial Hospital, New York City.
[1]Hospital for Joint Diseases, New York City.
[1]Cleveland Clinic Foundation, Cleveland, Ohio.
[1]Hospital of the University of Pennsylvania, Philadelphia.
[1]Medical College of Virginia, Hosp. Div., Richmond, Va.

1. Indicates temporary approval.

Army General Hospitals Close

Three more Army general hospitals will close on September 30. The Cushing General Hospital, Framingham, Mass., the Mayo General Hospital, Galesburg, Ill., and the O'Reilly General Hospital, Springfield, Mo., have been declared surplus to the needs of the Army Medical Department. With their closing, 19 of the 65 general hospitals operating during the war will remain in operation.

The Cushing General Hospital is being considered for use by the Veterans Administration.

National Hearing Week

With three million children in the United States having impaired hearing, there is more need than ever for a concerted effort to "Enlist for Better Hearing" during National Hearing Week, November 10 to 16, according to Dr. C. Stewart Nash, president of the American Hearing Society, Washington, D. C. The national organization is joined by its 120 local chapters throughout the country in this observance.

Honor Graduating Physical Therapists at Columbia and at D. T. Watson

The graduating class of Physical Therapists of Columbia University in the City of New York were honored by a reception held by the Faculty of Medicine, Friday, August 16, 1946.

The Directors and Faculty of the D. T. Watson School of Physical Therapy entertained in honor of the graduating class of Physical Therapists of the D. T. Watson School of Physical Therapy, Friday, September 27th, 1946.

Grant for Research in the Mechanics and Effects of Fever

A grant of $12,500 has been given by the United States Public Health Service to Emory University School of Medicine, Atlanta, Ga., to finance fundamental research in the mechanics and effects of fever by Dr. Paul B. Beeson, professor of medicine, and Dr. Albert Heyman, instructor in medicine and director of the venereal disease clinic at Grady Hospital, Atlanta. The two men have worked as a team for the past three years on research projects under similar grants from the Public Health Service, but this is the first year that they have turned their attention to the problem of fever. Their previous research has been devoted to various phases of venereal diseases, particularly the penicillin treatment of syphilis. Dr. Beeson was graduated from the McGill University Faculty of Medicine, Montreal, in 1933 and Dr. Heyman from the University of Maryland School of Medicine, Baltimore, in 1940.

Surplus Army Hospitals Released to Veterans Administration

The Army's great general hospitals are being released as rapidly as the decrease in patient load justifies and offered first to the Veterans Administration for medical care for veterans. Of twenty-five hospitals earmarked for the Veterans Administration at their request, eleven have been transferred complete to the last scalpel.

When three general hospitals housing paraplegic centers were released to the Veterans Administration on April 1, 1946, special equipment for the treatemnt of paraplegic patients remained in the hospitals in addition to the standard equipment turned over in all cases to the Veterans Administration. A part of this special equipment included wheel chairs, walking apparatus, special headphones for built-in radios, and shop facilities used in training the patients who are paralyzed in the lower half of their bodies. The treatment of the 700 patients in these centers continued uninterrupted despite the transfer of the hospital from Army to Veterans Administration. The patients received certificates of disability discharges

from the Army and immediately became patients of the Veterans Administration without leaving their beds.

In addition, the War Department plan includes placing Medical Corps, physicians, nurses, technicians, orderlies, and dietitians on temporary duty in Veterans Administration hospitals so that the care of the wounded may continue uninterrupted. The Veterans Administration has also been authorized to place employees in Army hospitals to observe specialized professional technics practiced by the Medical Department staffs.

Gardiner General Hospital

In response to requests for the conversion of the Gardiner General Hospital, Chicago, Ill., for nonmilitary use, Secretary of War Robert P. Patterson announced that it was necessary for the War Department to retain the property as Headquarters for the Fifth Army and Fifth Army Area.

Brig. Gen. Hart Honored by Medical Foundation

Brigadier General W. Lee Hart, USA (Retired) was awarded the degree of Doctor of Humanistic Letters early this month by Southwestern Medical Foundation, Dallas, Tex. General Hart was commander of Brooke General Hospital, Brooke Army Medical Center, from December, 1937, until June, 1940. He was later Medical Director, Eighth Service Command.

Bill Proposes Permanent Commissions for Army Nurses

A bill has been presented to the Congress asking that Army nurses and certain Medical Department specialists be given permanent commissioned status in the Army. The bill includes also physical therapists, dietitians, and occupational therapists and provides for the establishment of a Reserve Corps for each of these four categories similar to the Reserve Corps now in effect for other branches of the Army. The bill, if approved by Congress, will provide an authorized strength in the ratio of 6 nurses per 1,000 persons of the total authorized strength of the Regular Army with a minimum of about 2,500 nurses; the dietitians have a ratio of 0.35 per 1,000, with a minimum of about 150; the physical therapists have a ratio 0.3 per 1,000 with a minimum of about 128; the occupational therapists shall be in the ratio of 0.25 per 1,000, but not fewer than about 107 members.

Land for Five New Veterans' Hospitals

President Truman has approved acquisition of land for five new Veterans Administration hospitals, the transfer of two surplus military hospitals to the Veterans Administration for temporary use and major changes in the Veterans Administration hospital construction programs in Oklahoma and Missouri. The new sites are at Toledo, Ohio; Madison, Wis.; New Orleans, Dallas, Texas, and Klamath Falls, Ore.

The Toledo property, 160 acres of land just outside the western city limits, will be the site of a 1,000 bed neuropsychiatric hospital.

The Madison property, 24 acres of land within a mile of the University of Wisconsin Medical School and Hospital, will contain a 500 bed tuberculosis hospital. The site also is within 2½ miles of other Madison hospitals.

The New Orleans property, 5.6 acres of land close to Tulane University Medical School and Charity Hospital, will be the site of a 500 bed general medical and surgical hospital.

The Dallas property, 24 acres of land in the heart of the proposed Dallas medical center, will be the site of a 500 bed general medical and surgical hospital. Most of the property is owned by the Southwestern Medical Association, which recently purchased 80 acres for a new Southwestern medical college. The Veterans Administration site also is close to the new Dallas city-county hospital.

The Klamath Falls property, 16 acres of land just inside the eastern city limits, will contain a 200 bed general medical and surgical hospital. The site is about 1½ miles from the business center of Klamath Falls.

Eugene Stead, Jr., Joins Duke Faculty

Dr. Eugene A. Stead, Jr., who recently resigned as professor of medicine and dean of Emory University School of Medicine, Atlanta, has announced his acceptance of the professorship of medicine at Duke University School of Medicine, Durham, effective January 1. Dr. Stead, who graduated at Emory in 1932, has also been physician in chief of the Emory division of Grady Hospital since 1942.

National Society for Crippled Children and Adults

The annual meeting of the National Society for Crippled Children and Adults will be held December 9-11 at the Palmer House in Chicago, announces Lawrence J. Linck, executive director. Arthur K. Flanagan, counselor on recreation and rehabilitation of the National Society for Crippled Children and Adults, has received two appointments to act on national committes in the field of rehabilitation. Lawrence J. Linck, executive director, has named Mr. Flanagan to represent the National Society on the Committee of Affiliated Organizations of the National Rehabilitation Association. The other appointment was on the President's Committee on Camping in Education of the American Association for Health, Physical Education and Recreation, of which Miss Elizabeth Steinbecker of the University of Pittsburgh is chairman.

Discontinuance of Convalescent Hospitals

The demand for hospital beds during the fall of 1943 and the early months of 1944 resulted in the establishment of thirteen convalescent hospitals in the United States. These hospitals furnished about 50,000 beds for convalescent patients, most

of whom were from overseas. The hospitals provided a reconditioning program with a view to returning the patients to civil life. The complete program included the following services: educational reconditioning; physical reconditioning; occupational therapy; classification and counseling; physical therapy, and special services. Since little need remains for convalescent hospitals as such, they were, with the exception of the Old Farms Convalescent Hospital, Avon, Conn., discontinued as of June 30, 1946. The type of treatment found to be so effective in these hospitals will be provided by convalescent annexes which will operate as an integral part of each general hospital. It is anticipated that 20 per cent of the authorized beds in general hospitals in the United States will be required for the operation of these convalescent annexes.

Medical Department Exhibit

The exhibit covering Medical Department advances during World War II, which was displayed at the Ninety-Fifth Annual Session of the American Medical Association in San Francisco, July 1-5, was shown in Detroit, when the Association of Military Surgeons of the United States met in October, and in Washington. Numerous other requests from abroad and from Latin American countries have been received. The exhibit has fourteen parts and covers an area about half that of a football field. Many former Medical Department officers volunteered for temporary duty to assist in presenting the exhibit in San Francisco. Medical Department officers have estimated that if a medical scientist were to inspect each presentation closely it would take him seventy-two hours to cover the exhibit.

Conservation of Short Amputation Stumps

The Bulletin of the U. S. Army Medical Department for September, 1946 contains a report on two surgical procedures which have proved of value in conserving competent function in short amputation stumps—section of the biceps tendon in the upper extremity and of the medical and lateral hamstrings in the lower extremity.

Axillary Crutch Cushion

A rubber axillary crutch cushion (Med. Dept. Item No. 3666900) has recently been standardized and is now available in medical supply depots in ample quantities to meet demands in accordance with the basis of issue. It is the desire of The Surgeon General that stations submit requisitions without delay, in order that all patients using crutches may have this cushion rather than resort to the age-old custom of using rags.

Agreement to Facilitate Rehabilitation

A cooperative working agreement was signed September 11 by the Office of Vocational Rehabilitation in the Federal Security Agency and the Veterans Administration to facilitate vocational rehabilitation of veterans with a minimum duplication of effort and expense. The broad basic principles set forth in the agreement are intended to provide, among other things, that (1) state agencies will refer veterans who are eligible for services from the Veterans Administration to that agency in the event that they should apply to the States; (2) the Veterans Administration will refer veterans with non-service-connected disabilities to the State Vocation Rehabilitation agencies for such rehabilitation services as guidance and counseling, training, medical, surgical and psychiatric care, hospitalization, maintenance, occupational tools and licenses. These services are provided by the State Vocational Rehabilitation agencies primarily to nonveteran (3) to encourage establishment of local public and private clinics, rehabilitation and retraining centers.

Rehabilitation Center for the Hard of Hearing

The Army's new and ultramodern rehabilitation center for the deafened and hard of hearing received its first patients at the Forest Glen Section of Walter Reed General Hospital, Washington, D. C., recently.

National Arthritis Research Foundation

Lionel Barrymore has accepted the post of chairman of the board of the National Arthritis Research Foundation, formed early in 1946 by officials of the Leo N. Levi Memorial Hospital, Hot Springs, Ark., the only nonsectarian hospital in the United States devoted to free care of patients with arthritis. The Foundation has set a goal of $2,500,000 for research laboratories, to be located at Hot Springs, for study of the causes and cure and prevention of arthritis and closely related rheumatic diseases. A National Medical and Scientific Advisory Council has been formed to direct all research and medical activities, it was recently announced.

Director of Neuropsychiatry Consultants Division

Col. John M. Caldwell, M. C., U. S. Army, has been appointed director of the neuropsychiatry division in the Surgeon General's Office to succeed Brig. Gen. William C. Menninger, who was separated from the service on June 27.

New Medical Journal

J. B. Lippincott Company, Philadelphia, announces a new monthly medical journal for the "family doctor." The name of the new publication is American Practitioner, and the first number appeared in September. Dr. John B. Youmans, professor of medicine, Vanderbilt University School of Medicine, Nashville, Tenn., is the editor.

John J. Ower New Dean at University of Alberta

Dr. John J. Ower, professor of pathology, has been appointed dean of the University of Alberta Faculty of Medicine, Edmonton.

Grant for Research on Effects of Climate

A grant of $35,000 for the purpose of studying the effect of climate on the circulatory system has been made to the Tulane University of Louisiana School of Medicine, New Orleans, by the Life Insurance Medical Research Fund. This research work will be directed by Dr. George E. Burch, associate professor of clinical and experimental medicine.

Artificial Limbs

Outstanding European developments in artificial limbs and surgical technics for amputation have been reported by the group of scientists recently sent to England, France and Germany for this purpose.

This mission was headed by Dr. Paul E. Klopsteg. This research was started at the request of Surgeon General Norman T. Kirk and is now under the joint sponsorship of the Army and the Veterans Administration. No other country is conducting so extensive a program of research in this field. Of particular interest were improvements in kineplastic surgery and developments in the design of artificial legs.

George K. Howland

Announcement is made of the death in Boston, Mass., of Dr. George K. Howland, who for many years has been a member of the American Congress of Physical Medicine.

CORRESPONDENCE

Kenny Treatment

To the Editor: I noticed in your Journal, ARCHIVES OF PHYSICAL MEDICINE, dated September, 1946, an article entitled, "Report of the Meeting of the British Association of Physical Medicine on the Kenny Treatment." At the onset I would like to make a correction, for the film does not present the treatment but the Kenny Concept of the disease, infantile paralysis, and the end results of the treatment evolved for this Concept.

Dr. Phillipe Bauwens' criticism to myself was that the manner of presentation was too spectacular, however, I will take the privilegé of quoting his signed statement to myself, reading: "There is no doubt about it that you have stimulated thought and have produced a method of treatment which through attention to peripheral disturbances, produces excellent functional results."

At the same time this said film has been catalogued in the library of the Scientific Film Association of Great Britain at the special request of Dr. Philippe Bauwens. Dr. Bauwens requested further that the film be shortened a little and translated into all languages and sent to all countries. The film has also been catalogued in the Library of the Neurological Institute of Brussels, Belgium, at the special request of Dr. Leon Laruelle, and at the College of Physicians and Surgeons of Australia.

When quoting this article from the *British Journal of Physical Medicine and Industrial Hygiene*, Sept.-Oct., 1945, the unfairness of the medical critics is still present by the omission of the last and most important paragraph, that is, the concensus of opinion of the medical men present. This paragraph read: "The consensus of opinion appeared to be that the film demonstrated the importance of keeping tissue from contracting by mobilizing them from the earliest moment and also how this could be achieved even during the acute stages by the judicious use of moist heat. It also showed how motility having been conserved the greatest possible degree of motility could be obtained by special method of reeducation."

The whole paper has been quoted verbatim until it reached the last paragraph. Why was this part of the paper omitted and the remainder quoted in full? I am sure your readers would appreciate the publication of this letter.

ELIZABETH KENNY.

BOOK REVIEWS

THE TREATMENT OF BRONCHIAL ASTHMA. By *Vincent J. Derbes,* M.D., Instructor in Medicine and in Preventive Medicine, Tulane University of Louisiana School of Medicine; Assistant Visiting Physician Charity Hospital of Louisiana; Director of the Department of Allergy, Ochsner Clinic; and *Hugo Tristram Engelhardt,* M.D., F.A.C.P., Instructor in Clinical Medicine, Baylor University College of Medicine, Houston, Texas; Physician, Humble Oil and Refining Company, Houston, Texas; Adjunct in Medicine, Jefferson Davis Hospital, Houston, Texas; Formerly Instructor in Medicine, Tulane University of Louisiana School of Medicine and Visiting Physician, Charity Hospital, New Orleans, Louisiana. With chapters by a Panel of Contributors. Cloth. Pp. 466, with 61 illustrations. Price, $8.00. Philadelphia: J. B. Lippincott Company, 1946.

There can be little doubt in the mind of the average medical practitioner that bronchial asthma is one of the most discouraging and disheartening disorders to treat. The term asthma means to the clinician a symptom complex characterized by a wheezing or whistling type of recurrent dyspnea, having a prolongation of the respiratory phase of the respiratory cycle. The term bronchial asthma is understood to mean the forms in which symptoms result from edema of the bronchiole or spasm of the contiguous smooth muscle or both, the entire clinical picture being the result usually of an allergic mechanism.

Bronchial asthma has been recognized as a clinical entity for an untold number of years. Aretaeus, the Cappadocian, a clinician of ancient days ranking next to Hippocrates in his ability to describe and accurately picture disease, wrote about asthma in the second century, A. D. Jerome Cardan, professor of medicine at Pavia treated John Hamilton of Edinburgh Archbishop of St. Andrews for asthma. Cardan placed him on two frugal meals a day, made him drink a quart of milk, sleep ten hours at night, work and rest at regular periods during the day, ride horseback daily and take shower baths quite unknown at that time in Scotland. Following this regimen, the Archbishop rapidly grew better.

This book is of composite authorship and differs from other treatises on the subject in that it presents asthma not only from the viewpoint of the allergist, but also from the standpoint of the general practitioner and specialist in other fields. The subject matter is considered in two parts. In Part One the reader is oriented through eight chapters of basic fundamentals and in the fifteen chapters of Part Two the clinical aspects, diagnosis and treatment are fully discussed. The problem is fully covered; for example, the cardiovascular, the surgical, the parasitic or the psychologic phases. Since the physician is constantly confronted with the question of life expectancy of the asthmatic and other actuarian considerations the subject is authoritatively presented in Chapter Three.

The nineteen eminent contributors give clear, concise coverage. The book gives a thorough presentation of both intrinsic and extrinsic factors of bronchial asthma. This study is highly recommended to the general practitioner because it considers the whole subject from the viewpoint of the general practitioner and he will find the answers to those questions that arise when treating those problem patients.

A TEXTBOOK OF BACTERIOLOGY AND IMMUNOLOGY. By *Joseph M. Dougherty,* A.B., M.A., Ph.D.; Dean of the School of Science and Professor of Bacteriology, Villanova College; and *Anthony J. Lamberti,* B.S., M.S., Instructor in Parasitology, Temple University School of Medicine. Cloth. Pp. 360, with 102 illustrations. Price, $4.50. St. Louis: The C. V. Mosby Company, 1946.

This text simplifies the various phases of bacteriology and immunology and thus will secure the interest and enthusiasm of the average student in the premedical and predental courses. Instruction in the essentials of bacteriology and immunology should be required in premedical and predental education because the students having this preparatory education are usually better able to grasp the advanced instruction that can then be given in medical and dental schools. For institutions giving premedical and predental instructions in these subjects this book is admirably adapted. It is written in a delightfully simple and direct style with a minimum of confusing terms. This book stresses the needs of the undergraduates by treating thoroughly the fundamentals and therefore leaves to the graduate school the more exhaustive treatment common in so many textbooks in this field. The chief merit of this text is the clear approach for the undergraduate. Even the more advanced student will be benefited by its lucid presentation of fundamentals. This book furnishes a teaching pattern for the development of students of bacteriology and immunology in premedical and predental education.

MUSIC IN MEDICINE. By *Sidney Licht,* M.D., Fellow, New York Academy of Medicine. Pp. 132. Cloth. Price, $3.00. Boston: New England Conservatory of Music, 1946.

This is a scholarly and interesting monograph pointing out valuable relationships between music and the practice of medicine. In the first two chapters the history of music and psychologic effects are presented for the most part by direct quotations from the literature. The use of music in occupational

therapy is described in considerable detail from the point of view of offering remedial exercise by the use of various instruments. In the chapter on psychiatry and music brief descriptions of various diseases are given according to standard classification and suitable use of music suggested either by listening, participation in group singing or bands, or individual playing of instruments. A section is also devoted to background music as during calisthenics or shop work and at mealtimes with a list of suitable recordings. In the final chapters practical aspects are discussed of providing music in hospitals for bed patients with radios or public address systems and the requirements for a proper library and direction. The author also proposes a liaison between schools of music and medical colleges or schools of occupational therapy and outlines a four-year curriculum. Hospital directors and occupational therapists should find this book of definite value and it is of interest to the psychiatrist and other physicians musically inclined.

JOBS AND THE MAN. A GUIDE FOR EMPLOYERS, SUPERVISORS, INTERVIEWERS, COUNSELORS, FOREMEN, AND SHOP STEWARDS IN UNDERSTANDING AND DEALING WITH WORKERS — VETERANS OR CIVILIANS. By *Luther E. Woodward,* Ph.D., Field Consultant, Division on Rehabilitation, National Committee for Mental Hygiene; and *Thomas A. C. Rennie,* M.D., Associate Professor of Psychiatry, Cornell University Medical College; Director, Division on Rehabilitation, National Committee for Mental Hygiene. Fabrikoid. Pp. 132. Price, $2.00. Springfield, Illinois: Charles C. Thomas, 1945.

This book aims to give advice to those employing, supervising and counseling individuals with emotional problems including veterans and displaced war workers particularly. In the first chapter some of the difficulties encountered in changing from military to civilian life are described. Next, some of the problems of the "nervous" veterans or those with a psychoneurosis are explained on a superficial level suitable for lay readers. The important subject of job placement is discussed in the third chapter. Advice is given as to proper interview technic; the importance of finding individual adaptabilities and desires is emphasized and a few case histories are cited for illustration. Suggestions are also made as to proper handling on the job. The importance of personal and families' problems are stressed and professional psychiatric guidance is recommended in many instances. The concluding chapters present more details of the technic of industrial interviews and outline proper procedures to conform with veteran employment regulations. An adequate bibliography is appended, also questions for group discussions. This book is recommended to all vocational advisors and others dealing with industrial personnel problems and civilian rehabilitation.

AN INTRODUCTION TO ELECTRONICS. By *Ralph G. Hudson,* Professor of Electrical Engineering and Chairman of the courses in general science and general engineering at the Massachusetts Institute of Technology. Price, $3.00. Pp. 97, with 72 illustrations. New York: The Macmillan Company, 1946.

This small book is a brief introduction to the absorbing subject of electronics. It is not a book for the person who is desirious of making a serious study in this branch of science. It is a book well written, profusely illustrated and of real value to one desirous of learning some of the elementary principles of electronics for a cultural background. The subject matter is well chosen, accurate in its scientific presentation but brief. For those in the field of medicine it will be disappointing in the limited attention given to this growing field of application. Those of limited mathematical training will appreciate its non-mathematical presentation.

The author writes an excellent preface which is certainly well worth reading and digesting. The book contains chapters on: the constitution of matter; the flow of electricity; radio communication; reproduction of sound and picture; modern sources of light; more power to the electron; diverse applications of electronics and in addition a table of conversion factors.

THE VITAMINS IN MEDICINE. By *Franklin Bicknell,* D.M., M.R.C.P.; and *Frederick Prescott,* M.Sc., Ph.D., A.R.I.C., M.R.C.S.; Clinical Research Director, The Wellcome Foundation, London. Second Edition. Cloth. Price, $12.00. Pp. 916, with 208 illustrations. New York: Grune and Stratton, 1946.

The first edition of this work was published only four years ago. The advances that have occurred in this short time made another edition necessary. This reviewer did not see the first edition but certainly the present volume is the most up to date and complete work on this all important subject. According to the authors the chapters on Vitamin B complex have been largely rewritten and expanded. These chapters alone justify the publication. The chapters on the other vitamins are just as excellent. There is a tremendous amount of material in this book, as evidence cite the bibliography of some 4500 articles. The tables and charts are helpful. The illustrations are numerous and have an added value in that most instances the deficiencies are shown in humans and not in animals. Unquestionably this book can be recommended as one of the best if not the most informative and authoritative single volume on vitamins at this time.

PHYSICAL MEDICINE ABSTRACTS

Stabilizing the Knee Joint Through Thigh Muscle Development. Henry Funk.

Manitoba M. Rev. **26**:403 (July) 1946.

Inasmuch as the first line of defense of a joint is its muscles and the second line its ligaments, it immediately becomes apparent that the integrity of a joint is dependent primarily on the muscles which act upon it, with the ligaments coming into play mainly when the muscles are inactive.

This premise conveys numerous implications, and it is evident that if the muscles acting on the knee joint become weakened as a result of injury, disuse or disease the stability of the joint will be impaired. If, for example, the lower limb is encased in a plaster cast to immobilize a fracture and the thigh muscles are not used actively, then weakness ensues. Removal of the cast after a period of weeks or months will demonstrate marked impairment of function of the knee joint. This is due partially to the prolonged immobilization but chiefly to the thigh muscle weakness. Even noninclusion of the knee joint does not completely guard against such weakness, although impairment of function will be less if the cast has been a walking cast permitting some active use of the muscles.

Activating and redeveloping the strength of the thigh muscle is of wide application. The contraindications apply whenever rest of these muscles is imperative, e. g., the earlier stages of union of a fracture of the femur, repair of these muscles, fractures about the knee joint where active contraction will disturb the alinement, inflammatory processes, etc. In addition to preoperative and postoperative indications, osteoarthritic knee joints are greatly stabilized and often rendered painless by redeveloping or overdeveloping thigh muscle strength, and the necessity for wearing a brace or operative measures may be obviated. Similarly, injured cruciate and collateral ligaments need not be the source of much disability if the muscle strength is well developed. When fracture union has progressed to the point where muscle contraction will not disturb the position of the fragments, quadriceps exercises are indicated. Even in injuries below the knee, as in the foot, which prevent partial or complete weight bearing, the patient can by exercises prevent muscle weakness, and the circulation of the limb can also be kept in a much better state.

Having maintained the muscle strength throughout the period of convalescence, the patient never knows how much benefit he has derived from these exercises, and the attending physician will be gratified by the rapidity with which such a person becomes restored to usefulness.

Development of the muscles acting on the hip joint has been purposely omitted from the discussion, since these muscles do not act directly on the knee joint. But they also can readily be exercised by applying a similar principle. When a prosthesis is to be fitted, all groups of muscles should be developed preparatory to the fitting.

Management of Late Head Injuries. R. C. L. Robertson, and William G. Peacher.

Ann. Surg. **124**:40 (July) 1946.

There is no specific method of treating posttraumatic states, possibly due to the close association of physiologic ond psychologic factors, as suggested by Symonds. The authors have come more and more to rely on intelligent handling of the patient, early ambulation, sedation, psychotherapy and well-directed efforts at rehabilitation. This should include a well-organized program with graduated physical and educational facilities.

Disappearance of Painful Phantom Limbs After Electric Shock Treatment. J. E. Pisetsky.

Am. J. Psychiat. **102**:599 (March) 1946.

A man aged 55 with involutional psychosis precipitated by traumatic loss of both legs, with painful phantom limbs, experienced improvement in the psychosis after treatment with electric shock, with disappearance of the painful phantom limbs. Pisetsky noted that a patient with a painful phantom limb experienced a remission in his symptoms after a convulsive seizure. The use of electric shock therapy suggested itself as a method for the controlled administration of a convulsive seizure.

Postural Factors in Apical Tuberculosis.

Edit. J. A. M. A. **131**:897 (July 13) 1946.

Tuberculosis in the adult shows a remarkable preference for the apical regions of the lungs. After the disease has become advanced in one apex it often involves the opposite apex months or years before lesions can be demonstrated in the lower two-thirds of the lungs.

When an adult of medium height is standing or sitting, the weight of the column of blood rising from the right ventricle to the apexes of the lungs is greater than the mean pressure in the pulmonary artery; in a tall, narrow chested person the column of blood exerts a pressure greater even than the systolic pressure in the right ventricle. As the veins collapse easily, they cannot siphon blood over the apical capillaries and back to the left auricle. Thus one of the sequels of man's erect posture is to reduce the blood flow to the upper parts of the lungs to nil if the cardiac output and the pulmonary arterial pressure are at their basal levels, unless the subject lied down.

Preinvasive Carcinoma of the Cervix Uteri. Edgar R. Pund, and Stewart H. Auerbach.

J. A. M. A. **131**:960 (July 20) 1946.

A recognition of carcinoma of the cervix in a truly early stage is one of the recent advances in the effort to control the disease. There are many deficiencies in our knowledge of some aspects of the behavior of the surface growths, although there is sufficient evidence of their potentialities to command respect. There seems to be little reason to doubt that virtually all if not all preinvasive carcinomas are curable. For our material, clinical follow-ups are too incomplete and too early to deserve mention, but the authors agree that cure may be expected in virtually every instance and have given a good prognosis to their cases. Their experience would not recommend conservatism in treatment, however. The series includes 1 case in which the cancerous cells survived treatment with a small dose of radium and another in which thermal cauterization failed to destroy the carcinomatous cells located in mucous glands.

Physical Medicine in the Treatment of Children. Clive Shields.

Brit. J. Phys. Med. **9**:83 (May-June) 1946.

The commonest causes of lower motor neurone lesions are anterior poliomyelitis, peripheral nerve injuries, birth palsies (Erb's and Klumke's paralysis) and peripheral nerve lesions of uncertain origin, for example Bell's palsy.

There is now no doubt of the value of electrical stimulation combined with massage and active or passive movements in such cases. The old idea, however, that a degenerated muscle is easily tired by more than 5 or 6 contractions is being abandoned.

Electrical testing of young children may be extremely difficult, and it is advisable to allow the child to play with the apparatus, and for one of the assistants to get the patient accustomed gradually to the admittedly uncomfortable skin sensations which galvanic stimulation produces.

The commonest lesions of the upper motor neurons met with in children are the spastic paraplegias, Friedreich's ataxia and cerebral diplegia. Characteristically there is no alteration in the electrical reactions in these conditions, so that any form of electrical treatment is not required. General massage and relaxation exercises are indicated in the early stages, followed by reeducation and a table of exercises designed to improve coordination as the condition improves.

For orthopedic conditions massage, manipulation and faradic stimulation will be required after surgical procedures such as tendon transplantation and osteotomy and in the after treatment of fractures; it should be stressed again, however, that active cooperation and effort by the patient should be invoked from the earliest moment.

General postural deformities, including kyphololordosis and scoliosis and a combination of these conditions, will form a considerable proportion of orthopedic cases referred for remedial exercises.

General ultraviolet irradiation is of the greatest value; second degree erythema doses twice weekly for long periods are required in conditions of rickets.

A number of different skin conditions are referred to the physical therapy department for treatment, among the commoner of which are the following: eczema, alopoecia, impetigo and naevi.

Studies in the Mechanics of Synovial Joints: II. Displacements on Articular Surfaces and the Significance of Saddle Joints. M. A. MacConaill.

Irish J. M. Sc. **247**:223 (July) 1946.

MacConaill classifies articular surfaces as ovoid and sellar, and he describes experiments on joints and model surfaces. The results of these experiments are shown to be predictable from a simple theorem of the general geometry of surfaces. From an examination of the mechanics of circumductions, it is shown that saddle (sellar) surfaces are mechanically more efficient than ovoid surfaces for bringing about rotations combined with circumductions. Examples of the working of the last principle are drawn from joints of the hand and foot.

Hazards of the Medical Uses of Radiation.

Cur. Com. J. A. M. A. **131**:1214 (Aug. 10) 1946.

In a comprehensive review of the medicolegal aspects of the damage that may result from exposures to roentgen rays, radium and other radioactive substances, Dunlap, in Occupational Medicine describes well the hazards connected with radiation under different conditions. Radiation may damage tissue by direct injury to cells and by impairment of the local circulation. For unknown reasons the changes in the tissues become evident some time—weeks or months—after exposure, taking a chronic, slowly progressive course with decrease in healing power and in resistance to infection. Dunlap lists the most important specific types of injury from radiation under the heads of dermatitis, induction of cancer, necrosis of bone, gastroenteritis, changes in the blood and blood-forming organs, sterility and injury to the fetus. Dermatitis is the commonest unfavorable reaction and may follow diagnostic, therapeutic and occupational overexposure.

A child exposed to radiation in the uterus may suffer serious malformations, but there is no evidence that exposure to radiation of either parent before conception can hurt the child.

Any licensed physician, regardless of his training, may employ roentgen rays and radium in his practice, a situation which has been compared to a general permission to practice medicine with liability only in case of injury. It seems as though some legal restriction might properly be established to limit the use of roentgen rays and radium to persons familiar with their potentialities for good and for evil. In this connection there also arises the question of the liability of the physician who treats curable cancer with ineffective doses of radiation.

Action Spectrum of Keratitis Produced by Ultraviolet Radiation. David G. Cogan, and V. Everett Kinsey.

Arch. Ophth. **35**:6 (June) 1946.

A knowledge of the distribution of wavelengths and energies involved in the production of keratitis by ultraviolet radiation has theoretic and practical importance. Such information is fundamental to an understanding of the harmful photobiologic processes in the cornea and is prerequisite to the determination of exposure hazards and protective devices. The present report attempts to show quantitatively what bands of the ultraviolet portion of the spectrum are responsible for the production of keratitis and what relation the keratitis band has to the erythema band, to the characteristic absorption bands of some proteins and to the absorption of several types of common glass.

A curve relating wavelength to the quantity of energy just necessary to produce keratitis represents the action spectrum for keratitis, whereas a curve relating wavelength to the absorption of the corneal epithelium represents the absorption spectrum of the corneal epithelium. It is one aim of this study to correlate the action spectrum of keratitis with the absorption spectrum of a particular tissue constituent.

The action spectrum for keratitis has not previously been determined, although the long wavelength limit which would produce keratitis has been determined by use of filters, as in the standard work of Verhoeff and Bell.

The action spectrum for keratitis produced by radiation was determined on rabbit eyes. Relatively homogeneous radiations with sufficient energy to produce keratitis were obtained by means of a large quartz monochromator. The amount of energy at any one wavelength just necessary to produce a corneal change that was visible with the biomicroscope and slit lamp was considered the threshold dose for that wavelength.

The cornea was found to have a peak sensitivity to ultraviolet radiations at wavelengths of about 288 millimicrons, with a sharp decline in sensitivity to either side of the peak. The amount of energy necessary to elicit an ocular reaction at 288 millimicrons was approximately 0.15×10^6 ergs per square centimeter. Although the absorption peak of the corneal epithelium corresponded to that of nuclear protein (265 millimicrons), the peak of the action spectrum corresponded more nearly to the absorption peak of albumin and globulin (280 millimicrons). From this it may be inferred that the photochemical reaction in the cornea is due not to an indiscriminate absorption by nucleoprotein but, rather, to a selective absorption by a substance having a peak in the wavelengths longer than that of nucleoprotein or by certain constituents only of the nucleoprotein molecule.

The transmission characteristics of various types of common glass were measured for that portion of the spectrum which is responsible for keratitis. By comparison of these characteristics with the action spectrum for keratitis, it is possible to determine the amount of protection provided by any one glass for any wavelength or group of wavelengths.

An Electrolysis Apparatus Devised for Retinal Detachments. G. Gordon-Napier.

Brit. J. Ophth. **30**:478 (Aug.) 1946.

Electrolysis is a delicate and nontraumatic method of sealing the retinal tears, and the accuracy of the "strike" can be clearly observed with the ophthalmoscope if the negative electrode is used as the active electrode.

The indifferent electrode was covered with several layers of wet lint and was then bandaged on the upper arm. The usual exposure was made through the conjunctiva. The needle was fitted into the holder and the first application made in the desired position. For penetration the time of application varied depending on the thickness of the sclera. On no occasion was the time of application more than seven seconds and the usual time was about four seconds. The strength of current varied between 3 and 6 milliamperes. The needle was then detached from the holder and another needle fitted.

From records of 24 cases in which treatment was undertaken with this apparatus (though many more cases were actually treated), in 12 the retinas were reattached after the first operation and were still attached six months after operation. Of the remaining 12 cases, in 4 the retinas reattached after a second operation, performed three to four months after the first. In 18 cases treatment resulted in complete failure.

Ankylosing Spondylitis: Its Etiology and Pathology. C. W. Buckley.

Ann. Rheumat. Dis. **5**:49 (Dec.) 1945.

Buckley discusses the etiology and pathology of ankylosing spondylitis in the light of Batson's work on the venous circulation from the prostatic plexus. The influence of phosphatase on bone resorption and redeposition is described, and the possibility of a toxin from the prostate influencing this process is considered. The bone changes in rheumatoid arthritis, spondylitis and rickets are compared, and the conclusion is drawn that ankylosing spondylitis is not a form of arthritis but a toxic osteopathy. The possible influence of sex hormones is discussed and found to be "not proved" but calling for further investigation. The importance of the dates of union of the epiphyses and the bearing of the dates on the disease is mentioned; the effect of the age at onset on the prognosis in the light of the pathologic condition is pointed out. Further investigation is urgently required in view of the great increase in the incidence of the disease, particularly in cases which do not conform strictly to the classic pattern.

Music Is in Tune with the Art of Healing. Philip J. Jacoby.

Mod. Hosp. **67**:60 (Sept.) 1946.

Hospital music at all times should serve merely as background and therefore should be presented at low volume level. Under such conditions, it

will not interfere with conversation, reading or hospital functioning. It should not obtrude. It can be so arranged that the listener may reject the music if he wishes.

The modern hospital is wisely conscious of its public relations. The reaction to music by both hospital patients and visitors has been favorable. The progressive, efficient hospital can find an immediate job for music.

Treatment of Tuberculosis of the Larynx: An Evaluation. William F. Hulse.

Arch. Otolaryng. **43**:578 (June) 1946.

Ultraviolet ray therapy has long enjoyed extensive popularity in the general field of tuberculosis. In an earlier day it was considered absolutely essential, regardless of the type of disease which was present. Before present day concepts of tuberculosis therapy were established, sunlight and a nutritious diet shared the only therapeutic halo available. Modern therapeutic measures have somewhat dimmed the luster of these two factors. Actually, certain types of pulmonary tuberculosis are probably rendered worse by irradiation. The use of ultraviolet rays is contraindicated in the acute exudative type of pulmonary or laryngeal tuberculosis. The use of ultraviolet rays, either natural or artificial, has until recently been widely accepted as a somewhat exalted therapeutic measure in laryngeal tuberculosis, and the various contrivances which were used to pipe the rays to the seat of the trouble were ingenious, though there probably was little benefit derived therefrom. It is doubtful whether under the very best of conditions more than a small fraction of the rays ever survived the trip through the various contours of the hypopharynx. Since ultraviolet rays are capable of penetrating only to a depth of a few millimeters, those which did reach their destination left the actual seat of trouble largely undisturbed. Generalized exposure to ultraviolet rays has come to be accepted by many as being most beneficial in extrapulmonary tuberculosis, and the author assumes that laryngeal tuberculosis probably received some tangible aid from its use. It should be regarded solely as a supportive measure and nothing more.

Far out in front in the modern methods of attack on laryngeal tuberculosis is electrocautery. After this method was developed and recognized it superseded all others for a decade or more. At the zenith of its popularity it was considered to be appropriate for all forms of laryngeal tuberculosis, until more modern concepts of pulmonary therapy were developed. It has been recognized for some time that most infections in the body will do much better after an operative procedure if it is feasible to permit the body to wall off the infection to the greatest extent which good judgment will allow. If the body is not able to produce such a response, then cautery will be of no avail. If cautery is instituted before this has taken place, its employment may be expected to be disappointing, not only from the standpoint of eradication of the disease but also from that of physiologic function. A considerable number of patients are to be seen today whose general physical condition is functionally far superior to their laryngeal status, believed to be the result in the vast majority of instances of inopportune or overenthusiastic cauterization or both.

Electrocautery may be said to have two main functions. The first is the destruction of diseased tissues and the second a local stimulation of tissues due to the resultant hyperemia. Just what part each plays in a given case cannot be determined with any degree of accuracy.

Occupational Therapy in Eye Wards. W. O. G. Taylor.

Brit. J. Ophth. **30**:456 (Aug.) 1946.

Why should it be called a "therapy"? "The underlying theory behind it is that the provision of interesting and productive tasks for unwell people will assist them in accomplishing a cure." This is obvious in general medical and surgical cases.

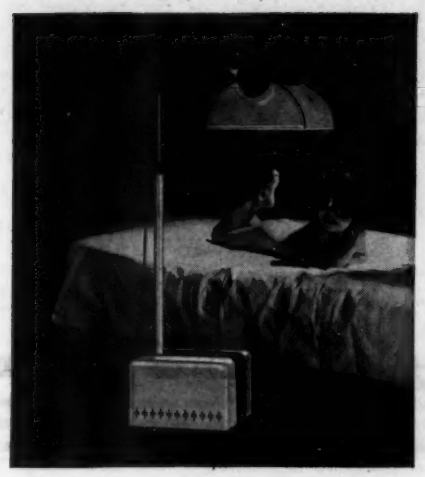
It is obvious that if a muscle is wasted one can give it exercise without the patient's knowledge by prescribing a craft which will call this particular muscle into play. But it is not so obvious in the case of diseases of the eye. Generally speaking, rest and not exercise is required. Here it might be said that the cheiroscope, used in the treatment of strabismus and heterophoria, is but a form of occupational therapy. One might well consider that careful thought should be given to the possibility of using crafts to achieve binocular fusion with the added psychologic impulse of real interests. For example, by analogy with nerve palsy elsewhere, there must come a stage in ocular nerve palsies where exercise is required and this might be achieved by weaving or stool seating with wools of complementary colors in the fashion of anaglyphs.

Epilation by Electrodesiccation of Hairs of the Scalp Infected by Fungi. Maurice J. Costello.

Arch. Dermat. & Syph. **54**:210 (Aug.) 1946.

Dermatologists have had the experience of finding it difficult to rid the scalp of the few remaining hairs infected by fungi after epilation by roentgen rays. Great difficulty is encountered in removing these infected hairs by manual epilation with tweezers because it is often impossible to grasp the hair, which has broken off near or at the surface of the scalp, or because it readily breaks under traction when held between the blades of the epilating forceps.

During the past three years, Costello has overcome the difficulty in epilation by inserting the fine needle of the short wave high frequency current into the hair follicle alongside the infected hair. When the current is turned on the infected hair is oftentimes attached to the needle when it is withdrawn. This operation should be performed in a dark room with the aid of the Wood fluorescent light. Complete destruction of the hair follicle does not always occur, and a normal healthy hair may later grow from the follicle.



As SOLAR RADIATION Diminishes

As the intensity of solar radiation declines, and as the days and hours providing effective exposure grow fewer, the need for supplementary ultraviolet irradiation rises sharply.

And not alone for its vitamin D effect in rickets, pregnancy and calcium-phosphorus deficiency — in stimulating reparation processes in convalescence and post-operative recovery — ultraviolet has a large field of usefulness and wide application throughout the year.

THE Burdick

QA-250-N
ULTRAVIOLET LAMP

— on dealer display — is built to meet the needs of average practice — moderate investment, ample capacity maintained without overload, lasting durability and trouble-free performance. Full hot quartz spectrum, rich in bactericidal and antirachitic rays. First degree erythema in two minutes (average) at 30 inches. Fully adjustable.

COUNCIL AMERICAN MEDICAL ASSN. ACCEPTED COUNCIL ON PHYSICAL MEDICINE *ACCEPTED*

The BURDICK CORPORATION
MILTON, WISCONSIN

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Archives of Physical Medicine, published Monthly at Chicago, Illinois, for October 1, 1946.

State of Ohio, } ss.
County of Cuyahoga. }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Walter J. Zeiter, M.D., who, having been duly sworn according to law, deposes and says that he is the Business Manager of the American Congress of Physical Medicine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management(and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Name of Publisher — American Congress of Physical Medicine, 30 North Michigan Ave., Chicago 2, Illinois.

Members of Editorial Board, ARCHIVES OF PHYSICAL MEDICINE.

John S. Coulter, M.D., 122 South Michigan Avenue, Chicago 3, Illinois.

Earl C. Elkins, M.D., Rochester, Minnesota.

Richard Kovács, M.D., 2 East 88th Street, New York 28, N. Y.

Fred B. Moor, M.D., 312 North Boyle Avenue, Los Angeles 33, California.

Walter M. Solomon, M.D., 1032 B. F. Keith Building, Cleveland, Ohio.

Arthur L. Watkins, M.D., Massachusetts General Hospital, Boston, Massachusetts.

Managing Editor — None.

Business Manager — Walter J. Zeiter, M.D., Cleveland Clinic, Cleveland 6, Ohio.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2, Illinois.

President—Walter S. McClellan, M.D., Saratoga Springs, N. Y.

Secretary — Richard Kovács, M.D., 2 East 88th Street, New York 28, N. Y.

Treasurer — John S. Coulter, M.D., 122 South Michigan Avenue, Chicago 3, Illinois.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) —None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

Walter J. Zeiter, M.D.

Sworn to and subscribed before me this 28th day of September, 1946.

Sophia B. Wunderle, Notary Public.

(My commission expires August 22, 1948.)

MEETINGS OF INTEREST TO THOSE IN THE FIELD OF PHYSICAL MEDICINE

In these columns will be published information about meetings of interest to those in the field of physical medicine. New data should be sent promptly to the office of the Secretary, 2 E. 88th St., New York 28, N. Y.

New York Society of Physical Medicine; meetings on first Wednesday, from October to May, New York City; Dr. Madge C. L. McGuinness, 51 East 87th Street, New York 28, Secretary.

The Pennsylvania Academy of Physical Medicine; meetings at the Philadelphia County Medical Building, 21st and Spruce Streets. Dr. Harold Lefkoe, 601 Medical Arts Bldg., Philadelphia 2, Secretary.

Southern California Society of Physical Medicine, Secretary-Treasurer, Dr. Clarence Dail, 802 Acacia Street, San Gabriel, Calif.

PARTIAL LIST OF PAPERS SUBMITTED FOR PUBLICATION IN THE *ARCHIVES*

Frequency - Intensity Curves of Normal and Paralyzed Muscles in Man. Harry D. Bouman, M.D., Assistant Professor of Physical Medicine; A. J. Kosman, Ph.D., Assistant Professor of Physiology; Stafford L. Osborne, Ph.D., Associate Professor of Physical Medicine, Northwestern University Medical School, and Andrew C. Ivy, Ph.D., Vice-President in charge of the Chicago Professional Colleges of the University of Illinois, Chicago.

A New Approach to Physical Medicine. Ben L. Boynton, M.D., Shannon West Texas Memorial Hospital, San Angelo, Texas.

A Poliomyelitis Program in a General Hospital. Josephine H. Buchanan, M.D., Assistant Professor, Physical Medicine, Medical College of Virginia, Richmond, Va.

The Effect of Thermal Shock on the Voluntary Neuromuscular Apparatus. Eben J. Carey, M.D., Dean and Professor of Anatomy, Marquette University School of Medicine, Milwaukee.

The Council on Physical Medicine. Howard A. Carter, M.E., Secretary, Council on Physical Medicine, American Medical Association, Chicago.

Measurement of Clinical Ultraviolet. Clifton B. Cosby, M.A., Assistant Professor of Biophysics, Baruch Center of Physical Medicine, Medical College of Virginia, Richmond, Va.

Physical Medicine and Rehabilitation in the Veterans Administration. Donald A. Covalt, M.D., Assistant Medical Director, Medical Rehabilitation and Physical Medicine, Veterans Administration, Washington, D. C.

The Evaluation of Disability and Rehabilitation Treatment of Paraplegics. George G. Deaver, M.D., Clinical Professor of Medicine, New York University Medical College; Medical Director, Institute Crippled and Disabled, New York, N. Y.

The Evaluation of Disability and Treatment in Hemiplegia. Harold Dinken, M.D., Assistant Professor of Medicine, University of Colorado School of Medicine; Director of Physical Medicine, Colorado General Hospital, Denver.

Reliability of the Single Effort Muscle Test. Ellen - N. Duvall, Ph.D., Research Associate, Physical Medicine, and Sara Jane Houtz, B.S., Instructor, Physical Therapy, Baruch Center of Physical Medicine, Medical College of Virginia, Richmond, Va.

Physical Medicine in the Navy. Comdr. Harry S. Etter, (MC), U. S. N., Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

Muscle Strength and the Weather. Ernst Fischer, M.D., Professor of Physiology, Baruch Center of Physical Medicine, Medical College of Virginia, Richmond, Va.

Physical Medicine in Treatment of Rheumatoid Arthritis with Associated Xanthomas. Everill W. Fowlks, M.D., Chief, Physical Medicine Service, U. S. Veterans Administration, Portland, Oregon.

Crossed Learning. F. A. Hellebrandt, M.D., Professor, Physical Medicine and Acting Director; Sara J. Houtz, B.S., Instructor, Physical Therapy and Annie M. Parrish, M.S., Instructor, Physical Therapy, Baruch Center of Physical Medicine, Medical College of Virginia, Richmond, Va.

The Role of Circulatory Changes in the Effectiveness of Thermogenic Agents on Deep Tissues. Harry M. Hines, Ph.D., Professor and Head, Department of Physiology and William D. Paul, M.A., Assistant Professor of Medicine, Director Department Physical Medicine, State University of Iowa School of Medicine, Iowa City, Ia.

Results of Combined Fever and Insulin Treatment in Schizophrenia. William A. Horwitz, M.D., Associate in Psychiatry; Franz J. Kallmann, M.D., Associate in Psychiatry, and Nicholas Kopeloff, M.D., Assistant Professor of Bacteriology, Columbia University, College of Physicians and Surgeons, New York, N. Y.

A Progress Report on the Development of the Department of Physical Medicine at the University of Southern California. O. Leonard Huddleston, M.D., Associate Professor of Medicine, University of Southern California, school of Medicine, Los Angeles.

An Early Progress Report on the Development of the Department of Physical Medicine at the University of Illinois College of Medicine. H. Worley Kendell, M.D., Baruch Fellow Physical Medicine, Mayo Clinic, Rochester, Minn.

Physical and Nervous Factors in Experimental Hypertension. Frederick J. Kottke, M.D., Baruch Research Fellow in Physical Medicine, Department of Physiology, University of Minnesota School of Medicine, Minneapolis.

Therapeutic Exercises in Management of War Injuries. Carl L. Levenson, M.D., Chester, Pa.

Ultraviolet, Infra-Red and Short Wave Dosimetry. Kurt S. Lion, D.Eng., Associate Professor, Massachusetts Institute of Technology, Cambridge, Mass.

Some Properties of Denervated Muscle. Sedgwick Mead, M.D., Boston, Mass.

Vertebral Changes Following Experimentally Produced Muscle Imbalance. Meryl Miles, M.D., Washington University School of Medicine, St. Louis, Mo.

Rehabilitation of Patients with Spinal Cord Injuries. Louis B. Newman, M.D., Physician in Charge, Medical Rehabilitation, Chief Physical Medicine Service, Veterans Administration Hospital, Hines, Ill.

The Optimum Exercise—Rest Balance in the Managment of Arthritis. George Morris Piersol, M.D., and Joseph L. Hollander, M.D., University of Pennsylvania, Philadelphia.

Comparison of Normal and Pathologic Patterns of Muscular Activity. Judith Partridge Price, M.A., Washington University School of Medicine, St. Louis, Mo.

A Study of the Kinematics and Dynamics of the Human Gait and Its Application in Poliomyelitis. Irving Rehman, Ph.D., Assistant Professor of Anatomy, University of Southern California, Los Angeles.

Cinematographic Roentgenographic Examination of Joint Movements. Russell Reynolds, M.D., London, England.

An Analysis of Certain Procedures Employed in the Physiatric Treatment of Amputations. Donald L. Rose, M.D., Silver Springs, Md., and George W. Soffe, M.D., Washington, D. C.

A Survey Method for Radiation Coverage of Infra-Red Generators. Leopold Rovner, M.S. (Physics), State University of Iowa, School of Medicine, Iowa City, Iowa.

Salient Observations on Physical Medicine in the Service. Herman L. Rudolph, M.D., Reading, Pa.

A Community Rehabilitation Service and Center. Howard A. Rusk, M.D., New York, N. Y.

The Growing Importance of Physics in the Premedical and Medical Curricula. Francis O. Schmitt, Ph.D., Head, Department of Biology, Massachusetts Institute of Technology, Cambridge, Mass.

The Role of the Physiologist in Physical Medicine. Wilbur A. Selle, Ph.D., Professor of Physiology, University of Texas, School of Medicine, Galveston, Texas.

The Influence of Muscle Action Tissue Repair. Sir Morton Smart, London, England.

A Report of the Progress in the Two Years Basic Development of the Department of the Organization and Integration of Clinical Physical Medicine and Research and Education. William B. Snow, M.D., Assistant Professor of Medicine, Columbia University, College of Physicians and Surgeons, New York, N. Y.

Physical Medicine in the Army. Benjamin A. Strickland, Jr., Lt. Col., M.C., Director, Physical Medicine Consultant's Division, Office of The Surgeon General, United States Army.

The Use of Inductothermy for the Stimulation of Nervous Tissue in Intact Animals. Robert Dewey Taylor, M.D., Cleveland Clinic Foundation, Cleveland, Ohio.

Psychiatric and Physiologic Studies on Fatigue: Preliminary Report. Arthur L. Watkins, M.D., Associate in Medicine, Harvard Medical School; Stanley Cobb, M.D., Psychiatrist-in-Chief, Massachusetts General Hospital; Jacob E. Finesinger, M.D., Assistant Professor of Psychiatry, Harvard Medical School; Mary A. B. Brazier, Ph.D., Research Fellow in Neuropathology, Harvard Medical School, Boston; Harley C. Shands, M.D., Harvard Medical School, Boston, and Gregory Pincus, D.Sc., Tufts College Medical School, Shrewsbury, Mass.

Temperature Equalization for the Relief of Pain. Herbert S. Wells, M.D., University of Minnesota Medical School, Minneapolis.

Physical Therapy in the Management of Tendon Repair. George D. Wilson, M.D., Asheville, N. C.

The Effect of Low Temperature on Fluid Movement and Capillary Permeability in the Forearm. Charles S. Wise, M.D., Harvard Medical School, Cambridge, Mass.; Ellen Brown, M.D., Harvard Medical School, Boston, and Edwin Wheeler, M.D., Massachusetts General Hospital, Boston.